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LEGAL MEDICINE

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TOXICOLOGY

BY

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PREFACE

The subject of Legal Medicine is one which is too little understood and appreciated by the general practitioner and medical student. This book has been written to fill the need of a single volume, treating the subject from as practical a point of view as possible and with special reference to the needs of the busy practitioner who suddenly finds himself confronted with a medico-legal case.

The author acknowledges his obligations to the many standard books on the subject and has tried to give due credit to the authors cited.

The subject of Psychiatry has been omitted, as it has become so specialized that it should be treated as such by an expert.

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PART I.

LEGAL MEDICINE

CHAPTER I.

INTRODUCTORY

As a rule, the terms legal medicine, medical jurisprudence, and forensic medicine are synonymous, and whichever one we use we can define it as that science which teaches the application of every branch of medical knowledge to the law, both civil and criminal. Its object is to enable the medical man to adapt his knowledge and experience to emergencies and to collate such facts as, when arranged and given as evidence, may be necessary to enable a judge or jury to arrive at a just conclusion.

The question as to whether legal medicine, as such, is entitled to a separate and independent place in the course of medical instruction, or whether it can be divided and placed under the many and varied subjects that are taught in the medical schools, is one that we are not concerned with here.

The definition given above necessarily implies that a medical jurist should have theoretical and practical knowledge of all branches of his profession, a wide range of experience and ability to adapt his knowledge and experience to emergencies. The variety of subjects which may arise in legal medicine may well appear overwhelming to the medical student. It is beyond the ability of anyone that he should be profoundly skilled in all the principles of medicine and jurisprudence and be able to answer all possible questions that may occur during the trial of a civil or criminal case. All that the law requires of a medical man is a fair knowledge of his profession and of that which belongs more particularly to the province of a medical witness. Naturally, the more one knows about his own profession the better he is able to follow and apply those principles to the practice of legal medicine.

The duties of the physician in his relations to the principles of legal medicine and in his relations to ordinary practice are widely divergent. The ordinary practitioner may have regarded as unimportant many things which he may be summoned to testify to in a court of law, and in such cases his deficiency is sooner or later found out. Many physicians after a few years in practice have suddenly found themselves face to face with matters apparently trivial, and from their inability

to testify in regard to them not only have found themselves in a serious position professionally, but their social and moral standing in the community has often suffered. So that, although the subject of legal medicine may appear dull and uninviting to most physicians, it is a subject which they should not neglect.

Members of the medical profession are often censured as the worst witnesses in matters of fact and opinion, and it is certainly the fault of the profession that its members are not always prepared for the questions which may arise in the cases in which they are required to give evidence. This applies not only to questions of matter of fact, but of opinion as well. On the other hand, it may be urged that the great diversity and complexity of the science of medicine is such that no one man can follow it in all of its intricacies. There is little sympathy for a man who, having no inclination to give proper attention to legal medicine, boasts of his ability, on account of his success in practice, to be able to go to court and to demonstrate to all concerned that he knows the whole subject, for sooner or later that man is doomed to overwhelming mortification.

The physician is at liberty to practice his profession or not. He may refuse to see one case, and is at liberty to accept the next, but the law provides that if he is connected in any way with a case whether professionally or not, he may be summoned, and in that case, he is compelled, whether he wishes it or not, to testify. The fact that he is not engaged in practice, that he does not even put out a sign as a physician, makes no difference. The physician is not permitted to wash his hands of legal medicine. In practice he may send a patient to some specialist for a certain condition, another patient to another specialist; but when he is called to attend a case which has medico-legal relations, then he cannot avoid telling in open court his connection with the case. In these cases he may often be able to exercise more or less reasoning powers, and may even, to a certain extent, play the part of a detective.

The whole field covers not only, as above mentioned, cases which are tried in the criminal courts, but those which occur in civil courts as well. One thing is sure: that training in medico-legal questions will develop self-reliance to a greater extent than almost any other field of medicine. One may be obliged to testify in open court before an audience of varying intelligence, and should make his explanations easily comprehended by those who have not had the training he has had.

In general we may divide the kind of practice a physician may meet with into two classes—criminal and civil. In the former the crime may be nothing more than simple assault and battery, or it may be murder in the first degree. Between these two extremes we meet with cases of abortion, rape, and other forms of violence. Civil cases have to do with action brought by one party against another. These cases include

action of tort; that is the suing of one party by another for damages, as a result of negligence on the part of the defendant. In this division also belong the question of insanity, the probate of wills, and divorce proceedings.

CHAPTER II.

SUDDEN DEATH DUE TO NATURAL CAUSES

All deaths fall into two classes, so far as legal medicine is concerned: those which result from natural causes and those which result from violence, whether accidental, homicidal, or suicidal. Under the first head come those deaths which on account of their suddenness are deemed worthy of attention and justify investigation. In the large dailies we can almost always find mention of some one who has "dropped dead", or been "found dead in bed", etc. However, legal medicine does not have to do with all sudden deaths. It has to do with those sudden deaths where the victim has not previously been enfeebled by any recognized disease, and has been about his usual routine, and in enjoyment of his faculties when death supervenes. Especially is legal medicine concerned with those who are found dead in bed, having retired in their usual condition of health.

Death Due to Heart Disease.—Any condition which interrupts the continuous flow of blood is a menace to life. Such conditions may occur within the heart or they may affect its functional powers, involving no hindrance to the flow of blood, or there may be a combination of both of these conditions.

Where the conditions are within the heart, we may mention cases of cardiac thrombosis, where the thrombi are so large that the passage of blood is hindered or prevented. As a rule, though, thrombi are too small to bring about this result. They may occur in any portion of the heart, generally in the appendages of the auricles. Thrombi formed in the ventricles are, as a rule, small. *In situ* they do not cause symptoms, but when removed from the heart and carried by the blood current to other organs they may cause sudden death by occluding the arteries of the vital organs. Auricular thrombi are generally larger than those found in the ventricles. Mural thrombi are occasionally met with. These are usually found at the openings of the heart, and may prevent the free entrance and exit of the blood. Occasionally thrombi are unattached to the cardiac tissue; they are more or less round in shape and gradually increase in size. Emboli may be carried to the right side of

the heart by the systemic circulation, thus obstructing the flow of blood. If such a condition is the cause of death the clot must be of considerable size, and probably is to be found in the right ventricle. It may originate in any inflamed varicose vein or during an attack of phlebitis.

Where the heart itself breaks down and does not respond to the call for extra exertion, it may be that the cardiac muscle is at fault or that the valves are injured. Many cases of sudden death are due to changes in the myocardium interfering with its contractility. A degeneration in the walls of the coronary arteries is here often a fundamental cause. Normal circulation in the coronary arteries is undoubtedly necessary for the heart function. They may be occluded by thrombosis or embolism or have their caliber diminished by arteriosclerosis. As a result that portion of the organ which is supplied by the occluded or narrowed artery becomes necrosed, as well as the wall of the artery itself. In such a case the necrosed area will be anemic and pale, and we have a condition that is called white infarction. Occasionally stasis results, and we may have hemorrhagic infarction instead. As a rule, however, the changes in the muscles are due to a gradual narrowing of the artery resulting in imperfect nutrition and degeneration of the muscular tissue. This condition is known as fibroid myocarditis. It is characterized by the presence of white, opaque masses of fibrinous tissue replacing the muscle. It is usually limited to the left side of the heart because the anterior coronary artery is more apt to be affected.

Spontaneous rupture of the heart is not so very uncommon, but does not occur if the myocardium is sound and healthy. Men are more subject to it than women. The left ventricle is usually the situation, and the rupture takes place from within outward. As a rule, it occurs late in life, and most of the victims are from sixty to eighty years of age. The rupture is generally a straight passage through the wall of the heart, the edges being more or less ragged. Occasionally the rupture is the result of the blood's burrowing through the myocardium, when the external opening may be some distance from the internal one. Arteriosclerosis, causing occlusion of the coronary arteries, causes perhaps more sudden deaths than any other form of heart disease. Occasionally such a death is preceded by attacks of angina pectoris.

Death from valvular disease of the heart is not very common, and is of much less interest to students of legal medicine, inasmuch as the condition has been diagnosed beforehand, and it cannot properly be classed as a cause of sudden death. Death in these cases may be delayed for over an hour, depending upon the size of the rent in the valve. In such cases the mechanical interference of blood within the pericardium is a serious one and may be the cause of death, rather than the loss of blood.

Aortic aneurysm is perhaps the most common cause where the lesion

is in the blood-vessels. It is a dilatation of the aorta as a result of the weakening of the arterial sheaths. This leads to the development of a sac along the course of the vessel. It occurs, as a rule, in middle life, and more frequently in men than in women. Occupation has an important influence upon its formation. As a rule, there is no evidence of its existence, and rarely even clinically do the symptoms denote its presence. Generally the patient is about his usual vocation, experiencing possibly slight dyspnea, when suddenly after unusual effort or strain the aneurysm ruptures and a sudden death by hemorrhage ensues. Aneurysms of the ascending aorta most frequently burst into the pericardium and the right side of the heart; those of the transverse aorta break into the trachea, left lung, left bronchus, pleural cavity, and sometimes into the esophagus; those of the descending aorta discharge into the pleural cavity, esophagus, and abdominal cavity.

Death Due to Brain Lesions.—The most common cause of death from lesions within the central nervous system is hemorrhage into the cranial cavity, popularly called apoplectic "stroke" or "shock". On the other hand, hemorrhage within the cranium may not be attended by apoplexy, nor is it necessarily dangerous to life. The situation of the hemorrhage is of more consequence than the extent. If the rupture of the artery is at the base of the brain, the shock is almost lightning-like. Most often is the hemorrhage in the vicinity of the medulla, the cerebrum, the pons, or the cerebellum, in which cases the effects are those of compression of the medulla by the blood. Hemorrhages into the brain above the pons may cause rapid death, but not sudden death. There is unconsciousness, stertorous breathing, and other well-marked symptoms before a fatal termination ensues, which may not be for some days. This is the most common cause where people are found in the morning "dead in bed".

The only other lesions of the central nervous system which are at all connected with sudden death are a certain class of neuroses. An epileptic seizure may take its victim when alone, and fatal asphyxia may supervene. In such a case the autopsy will reveal the appearances of death by asphyxia, but nothing distinctive of a lesion in the central nervous system. Convulsions caused by other diseases than epilepsy may bring about the same result.

Under this class of lesions of the central nervous system should be included cases of death from shock and inhibition, although there may be no lesion to show the cause of death. Such cases are not rare in medical literature.

Death from Lesions of the Respiratory Organs.—Pulmonary embolism is a condition in which death is most rapid. It is always secondary to some lesion elsewhere, although it may itself be the immediate cause

of death. Thrombosis should be included among the causes of sudden death. It is due to the rupture of an artery whose walls have been weakened; as a rule, in a tuberculous lung. Cases are on record where death has been due to suffocation from the abundant hemorrhage as the result of such a rupture.

Pneumonia is quite a common cause of sudden termination of life. As a rule, such cases are those which have not received medical attention and which do not feel particularly sick, suffering only from a heavy cold on the chest.

Death due to Lesions of the Digestive Organs.—The pancreas is the only one we need speak of. Hemorrhagic pancreatitis or pancreatic apoplexy gives rise to a few symptoms which are very peculiar and rarely diagnosed. The symptoms are pain in the epigastrium, nausea and vomiting, tenderness in the epigastrium, and a rapid decline. When occurring in a person previously perfectly well it may give rise to suspicion of poisoning, but the postmortem examination will easily determine the true cause of death.

Rupture of the spleen may be the cause of sudden death after a miliary infection, and we also find cases of rupture of the normal spleen as a cause of sudden death.

There are certain conditions of **the pelvic viscera,** especially of females, which are occasionally the cause of sudden death. Extra-uterine pregnancy may produce, by rupture of the tube into the peritoneum, tremendous hemorrhage followed by collapse, and generally it is so rapidly fatal that surgical interference is impossible.

CHAPTER III.

SIGNS OF DEATH

The question whether a person is dead or not is of very great importance, both from the moral point of view and from its medico-legal aspect. In the former we meet with the prevalent idea that people are buried alive occasionally. Under the latter consideration we have to decide whether the person is really dead or only apparently dead; and if dead, how long a time has elapsed, and how death supervened, whether from violence, accident, or natural causes; in certain cases, especially those involving the death of two or more people, either homicidal or accidental, which one died first.

Death may be defined as "cessation of the vital functions and of the general renewal of tissue consequent on that cessation" (Luff). Somatic death is described by Draper as "death of the body as a whole in consequence of the suspension of the vital functions". It expresses the idea of death as it exists popularly. The person is dead or appears to be dead.

Molecular death is the final condition in the process of death. Decay begins and signs of death are no longer doubtful. Between somatic and molecular death there is an interval of longer or shorter duration wherein resuscitation is possible, and the apparent death may lead to error unless the fact of death is determined by careful means. So that a thorough understanding and knowledge of the signs of death is of the utmost importance. Often people request or direct in their wills that a medical man pronounce death and certify thereto before burial takes place. Many books have been written on the idea of people being buried alive, but the stories are almost incredible.

Physicians should be on their guard, as there are many conditions of the nervous system which may simulate death. Catalepsy, hysteria, and hypnotic coma are examples. Prolonged syncope, as in heart disease and asphyxia, in drowning, and in the new-born, may give rise to the opinion that a person is dead. Many cases are on record illustrating these latter facts. One is the case of a young woman who was in a cataleptic state for eight weeks. Another case is reported where a woman eight or

nine months pregnant apparently died. She was buried with her rings on her fingers and her greedy servants undertook to rob the grave. The woman's fingers were amputated, and blood flowed, and the servants were frightened off. The same night her husband was awakened by his wife's knock at the door. Later, the woman was delivered of her child, who became an eminent physician.

Occasionally people are met with who can voluntarily control the action of the heart and lungs to such a degree as closely to simulate death. Such people apparently can reduce the volume and number of the respirations so much that there is apparently cessation; also the pulse and action of the heart gradually diminish so that it is imperceptible at the wrist, and may not even be detected by auscultation. In India this is voluntarily practiced by the natives, and they occasionally allow themselves to be buried for two or three weeks and are then resuscitated. In the animal kingdom similar phenomena are not uncommon, especially in hibernating animals, as here they practically undergo apparent death.

The signs of death may be enumerated under the following headings: complete and continued cessation of the heart's action; the complete and continued cessation of respiration; changes in the temperature of the body; rigor mortis or cadaveric rigidity; changes in the skin and in the eye. Other signs are putrefaction, mummification and the formation of adipocere, but these occur much later than the others. The cessation of the circulation and respiration, except for a very brief interval is regarded as sufficient to determine the actuality of death. Life may be maintained during a brief suspension of these functions, but unless they are quickly reëstablished death ensues. To detect the cessation of the heart's action the stethoscope or, better, the ear should be applied directly to the chest wall over the area of superficial cardiac dullness. If no sound or movement of the heart is noticed after five minutes' listening death may be regarded as certain. If there is any doubt at all in the physician's mind this examination may be repeated at the end of one-quarter or one-half hour. The mere absence of the pulsation of the radial artery at the wrist is no sign of cessation of the heart's action. The complete cessation of respiration can best be determined by the absence of alternate movement of the chest and abdomen. The stethoscope may be employed to ascertain whether respiration has ceased or not; auscultation being practiced over the second costal cartilage on either side to ascertain whether air is entering the bronchi. The common test of holding a mirror in front of the person's mouth or suspending small bits of cotton in front of the mouth and nostrils is practiced, but auscultation is by far more reliable. If in any doubt do not be in a hurry; examine again in fifteen minutes or half an hour, and be sure that respiration has absolutely ceased for five minutes.

There are certain changes in the eye which furnish confirmatory evidence that the person is dead. The expression of the eye is noticeably changed; as a rule, it loses its luster; it sinks in its socket and becomes flaccid; the pupils do not react to stimulation, although this latter symptom is not peculiar necessarily to death; the marked changes can be noticed by the ophthalmic examination, due to the arrest of the circulation.

Changes in the muscular system occur also; the eyelids droop; the jaw drops, and the sphincters are relaxed. Changes in the expression of the face occur; it may be calm without the suggestion of pain or drawn and contracted.

Soon after the suspension of these vital functions the beginning of molecular death appears. Muscular irritability is lost. Of course, later, there may be muscular contraction, which will be spoken of under Rigor Mortis.

With the cessation of respiration and circulation, which also includes the cessation of nutrition, the body acts like any other material thing, and rapidly lowers its temperature to that of the surrounding atmosphere. This had best be determined by use of a thermometer which is provided with a scale registering as low as the temperature of the room or the place where the body is. The cooling is rapid at first, especially if death was preceded by fever and heightened temperature. Burman gives the rate of cooling as 1.6° F. per hour, but this is at best only a rough approximate determination, as the conditions under which the body lies vary greatly. Authors on this subject give a wide variation in the time necessary for the complete cooling of the body. The limits are set from four to twenty-four hours. Draper, who has made an exhaustive study of the subject, makes the period much longer. There are so many conditions entering into a decision on this point that it is hard to give an opinion. The time of the year, whether mid-summer or mid-winter, of course, is important, and also whether the body is completely covered or only partially so. Those parts which are thinly covered of course cool more quickly. If the body lies in the open air or is exposed to draughts of air, or if it is in the water, as in death by drowning, or if it lies upon a cool surface, the cooling is much more rapid. A thin body naturally cools much more quickly than one with a large amount of adipose tissue.

The time required for a body to become cool should be determined not from the parts which first become cool, but from those which are the last to give up their heat. In other words, it should be determined when the whole body has been uniformly cooled to the temperature of the room. A determination of the length of time intervening after death may be of importance in cases of homicide, and occasionally

when more than one person has died at about the same time, the determination of priority of death may be important.

Occasionally there occurs a postmortem rise of temperature instead of the customary cooling, but this is more or less transitory. The color of the skin after death changes to a distinct pallor, although this may not be particularly noticeable in people of extremely ruddy complexion. As the blood settles into the dependent parts of the body, changes take place due to the hypostasis and diffusion of the blood in the surrounding tissue. The dependent portions will show in from three to ten hours bluish or purplish discoloration and will be more or less œdematous. If the position of the body is changed, these spots may tend to disappear and other spots appear in the new dependent portions. If twelve to fifteen hours intervene before the body is moved, these discolorations will not disappear, although they may grow pale, and after thirty hours the secondary discoloration will not appear in other places. Sometimes these discolorations may be mistaken for ecchymoses that have resulted from an act of violence, but they can be easily differentiated, as the hypostatic discoloration on incision allows the escape of blood-stained serum, whereas ecchymoses, on dissection, will show evidence of blood or blood-clots.

The same hypostatic discoloration appears in the various internal organs, especially in the lungs, brain, kidneys, and intestines. In the lungs they appear within twenty-four to thirty-six hours after death, although occasionally they may appear earlier. In bodies that have lain on the back for a considerable time both lungs at their posterior portions will be found of much darker color than the anterior portions, and on section, bloody engorgement is seen. The brain also shows more or less hypostatic congestion, even in case of death by hemorrhage. This appearance, however, must not be mistaken for hyperemia, and thus a mistaken diagnosis of apoplexy be made. The appearance of the intestines may be deceptive; if only small portions are examined, it may lead to the suspicion of disease, but if the whole length of the gut is examined, the appearance cannot be mistaken.

CHAPTER IV.

RIGOR MORTIS AND PUTREFACTION

After death there is a relaxation of the muscles, accompanied by their diminished excitability. If the muscle was healthy before death it may respond to electrical stimulation, but this response is much decreased. This muscular relaxation includes the relaxation of the sphincters. Later, this muscular relaxation is followed by one called cadaveric rigidity, rigor mortis, or postmortem rigidity.

Rigor mortis may be simulated by catalepsy; but in the latter there is some evidence of life, and, too, the temperature of the body is normal, and after moving a rigid extremity it tends to return to its original position, which is not the case in rigor mortis. Rigor mortis follows death from any cause, and is an indisputable sign of death. This rigidity extends over the whole body, or at least over the skeleton muscles, and generally appears first in the neck and jaws, spreading to other portions of the body. It appears generally in from two to six hours after death, and usually persists for from twenty-four to forty-eight hours; but both of these periods are subject to great variations. Many conditions and circumstances modify the period of development, the degree and the duration of cadaveric rigidity. It develops early after death from long-continued exhausting disease or convulsive poisons; after prolonged muscular exercise or fatigue, and also after cholera. It rarely appears before the heart stops, although it probably commences at that time. It always appears within twenty-four hours after death.

When death has followed violent muscular exercise, rigor mortis sets in early and persists for a short time. This is shown by a case reported as follows: "A brakeman, who had been in muscular activity just before death and was coupling together two railroad coaches having platforms of unequal height, was suddenly compressed by the backing of the engine. Apparently the platform of the forward car struck him in front just below the diaphragm, while the platform of the other car struck his back about four inches higher. Death was instantaneous. Rigor mortis began in twenty minutes after the accident; it was present

in the head and trunk at that time, not having reached the lower portions of the body, but six hours later the whole muscular system was in a state of strong muscular contraction. When first seen after the accident, the right forearm was extended upward, and the left was stretched out from the body, slightly flexed at the elbow-joint, in the position assumed for dropping the pin into its socket, while the other hand was held up to signal the conductor." This illustrates the early appearance of rigidity after death.

The age of the subject modifies considerably the degree of rigor mortis. In children it is slight; while in adults it is marked, and in old age (although authors differ) it probably depends upon the degree of nutrition of the muscles. The various wasting diseases, such as phthisis, are characterized by slight rigor mortis. This also applies to infectious diseases, such as peritonitis. Certain poisons, such as the narcotics, produce slight postmortem rigidity, while strychnin and other irritants produce marked rigidity. The idea that rigor mortis did not set in after death by lightning is explained by the fact that the rigidity is of extremely short duration and may be not noticed. Death by lightning is followed by rigor mortis.

The length of time that rigor mortis persists is variable. It may be shortened by any of the means that promote decomposition, such as heat and moisture. It is of short duration in those cases where it is slight, such as typhoid fever, peritonitis, phthisis, and cancer. It is prolonged, on the other hand, in the cool, dry atmosphere of winter, in cold water, as in drowning, and in death by suffocation or strangulation; and in those cases where its degree is marked, such as in strychnin poisoning and in healthy muscular adults whose muscles had not been previously fatigued or exhausted.

When once rigor mortis is developed and the limb is forcibly flexed or extended, thereby breaking up the rigor mortis, it will not reappear. But if it has not been completely developed and such movements are made it will appear in the limbs again afterward.

As rigor mortis undoubtedly begins immediately after death the body will assume the position, and later stiffen into exactly the same position as that in which it lay at the time of death. This point often is of assistance in forming an opinion as to whether the death was homicidal or suicidal.

Cadaveric Spasm.—Rigor mortis may be developed at the moment of death and may include the whole of the body, so that the body stiffens in the exact position of its last act. It is seen more often and characteristically in sudden death by violence, although it may occur after any kind of death. Numerous instances of this peculiar manifestation are recorded. Most of them are from battle-field experiences.

This phenomenon of cadaveric spasm may be of assistance in differentiating between homicides and suicides. We occasionally meet with cases of death where the person has shot himself or inflicted injuries by other instruments. In these cases the knife or revolver may be found tightly grasped in the hand, and this is presumptive proof of suicidal death, as this cadaveric rigidity coming on instantaneously cannot be simulated by artifice. Cadaveric rigidity disappears after a while, as mentioned above, and there ensues a period of muscular relaxation. At this time molecular death has set in, and the muscles will not respond to stimulation.

Rondeau draws the following conclusions from his experiments on rigor mortis:

1st.—Contrary to the opinion of Hunter, muscular rigidity occurs after death by lightning; its appearance and duration are very variable.

2d.—Chloroform, whether by its introduction into the stomach or lungs, appears to prolong the duration of rigor mortis, though it has no apparent influence upon its production.

3d.—Phosphorus has no definite action upon the conditions of rigor mortis.

4th.—Morphin and laudanum—no facts worthy of note.

5th.—Cyanid of potassium appears to have a definite effect upon the time of appearance and duration of postmortem rigidity. It usually appears in a few hours, and persists for two or three days.

6th.—Arsenic does not modify postmortem rigidity.

7th.—Oxalic acid apparently hastens the appearance of rigidity, which is preserved for a relatively long time.

8th.— . . . Does not relate to the question of rigidity.

9th.—Salicylate of sodium apparently causes the early appearance and a very rapid disappearance of rigor mortis.

10th.—Sulphate of quinin, according to Niderkorn, causes an early and somewhat prolonged appearance of rigor mortis, during which decomposition rapidly goes on.

11th and 12th have no conclusive bearing upon this subject.

13th.—Death by drowning does not modify rigidity.

14th.—A fetus born dead is in a state of muscular rigidity.

Putrefaction.—The changes taking place following this muscular relaxation interfere more or less with the preservation of the body. As a rule, these changes tend to putrefaction, but they may tend to mummification or adipocere. The beginning of putrefaction is shown externally by an extension of the cadaveric lividity to the other parts of the body. A greenish discoloration appears on the front of the abdomen and flanks, and gradually spreads over the whole surface. This is due to decomposition of the hemoglobin and the formation of sulphid of hydrogen. The putrefaction is hastened by the exposure of the body to heat and moisture, and the free access of air. If the air is dry rather

than moist, putrefaction is not so apt to ensue as mummification. The most favorable temperature to assist putrefaction is from 70° to 90° F. Below the freezing-point and above the boiling-point of water putrefaction is arrested. The popular notion that a dead body is best kept in a large room with free ventilation is erroneous. A small tightly closed room prevents putrefaction much better. The action of the air is obvious. Putrefaction goes on only moderately fast under water; that is, a body that is submerged decomposes more slowly than when the body is above ground, and if the body is buried in the earth and the access of air and water prevented to a considerable extent, the process is still slower. Bodies found in peat bogs and dug up after several years show but slight putrefaction.

Casper says: "At an average temperature the degree of putrefaction present in a dead body after lying in the open air for one week corresponds to that in a body after lying in the water two weeks, or after lying in the earth in the usual manner eight weeks." "Putrefaction is twice as rapid in the air as in the water" (Hofmann).

The character of the soil of the cemetery has much to do with the rate of putrefaction. Sandy and gravel soils which allow free circulation of air are more favorable to rapid putrefaction than clayey soils which occlude the air. In the same way, coffins made of soft wood, such as pine, permit much more rapid decomposition than those made of hard wood.

The cause of death modifies the rate of putrefaction to some extent. In septic conditions and in death by suffocation, in death that has been accompanied by dropsy, or death that has been caused by poisoning, especially strychnin and other convulsive poisons causing severe muscular exercise, putrefaction sets in more rapidly. In those who have died as a result of muscular violence, as well as those who have a large amount of adipose tissue, putrefaction is rapid. As a rule, putrefaction is more rapid in the bodies of young persons than in those of adults, the cause of death being the same. On the other hand, putrefaction is retarded in those who are without much adipose tissue, in those who have died as a result of some chronic wasting disease unaccompanied by dropsy, and as the result of fatal hemorrhage, and in those cases of death where antiseptic poisons, like arsenic, phosphorus, zinc chlorid, corrosive sublimate, antimony, or chloroform, have been used.

Adipocere.—Putrefaction may begin only to be succeeded by a process which might be called saponification; that is, there is formed from the tissues an impure ammoniacal soap which has a consistence between that of fat and wax, and melts at about 93° C. This condition is known as that of adipocere. This substance, adipocere, is partially soluble in alcohol, and on heating gives off ammonia. Any part of the body may

undergo this change, and when once it takes place remains unaltered indefinitely. According to Devergie, the female breast is the first part to undergo the change; next come the cheeks, etc. Fat people are especially subject to this peculiar change.

According to Devergie, the change may begin in from six to eight weeks, and he claims that it takes a year under water, or three years in moist graves to convert the whole body into adipocere. Casper maintains that it requires three or four months in water and six months in the earth before beginning. Moisture with the absence of air seems to tend to the formation of adipocere; that is, bodies buried in deep graves or in moist earth undergo this change more rapidly.

Mummification.—In certain cases putrefaction is arrested and the body becomes desiccated, with the result that mummification ensues. The tissues become hard and dry, of a brown or black color, and are without odor. This mummification occurs particularly when the body is exposed to a current of dry air, and probably begins soon after death. The body may be preserved in this manner almost indefinitely, as is shown by the preservation of the Egyptian mummies.

Determining the Time of Death.—To determine the length of time that has elapsed since death is often important in legal medicine. Vibert says that if the body is warm and supple less than twenty-four hours have intervened since death. If the temperature of the dead body is that of the surrounding air, without rigor mortis, the period is less than thirty-six hours; if postmortem rigidity is present in fair degree and there is some hypostatic lividity, the period is between twelve and forty-eight hours. If the rigor mortis has disappeared and the hypostatic congestion is marked, the period is probably four or five days. If putrefaction has set in and there is greenish discoloration of the abdomen, if the superficial veins are livid and gas has developed, then the period is from three to six days. Beyond this time only approximate statements can be made, and at the best it is only an opinion.

Casper gives the rate of decomposition in the internal organs as follows: The trachea and larynx are the first to show evidence of decomposition. The thin mucous membrane of the trachea exhibits a peculiar paleness throughout its whole length, except where death has been produced by suffocation. But when decomposition has progressed a little further and the peculiar green appearance of the abdomen and the lividity of the superficial veins occurs, which is in from three to five days in summer, and six to eight days in winter, this thin mucous membrane has assumed a dirty red color. This appearance occurs before marked decomposition is visible in the other internal organs. Later the mucous membrane becomes olive-green in color, the cartilages separate and the whole organ disappears.

The brain of infants is the next organ in point of time which is decomposed. It changes to a thin, pulpy mass of a red color, which empties itself as soon as an opening is made in the skull.

The stomach is one of the first of the internal organs to undergo decomposition. At first there are irregular dirty red spots at the fundus, varying in size; these appear first on the posterior surface, where they are probably due to a certain extent to the hypostatic congestion, and later appear on the anterior surface; the color changes in time from a red to a dark gray.

The intestines assume a dark brown color which should not be mistaken for the peculiar color of bile. Later the intestines rupture and discharge their contents into the peritoneum.

The spleen, if not diseased, resists putrefaction much longer than the intestines. Gradually it becomes soft and assumes a bluish color.

The liver may remain sound for some time after death. In infants it decomposes earlier than in adults. The color is at first green, which is seen on the convex surface, gradually spreading over the whole of the organ, and later changing to black. The size gradually lessens as the fluid contents escape by evaporation or other means.

The brain in an adult in decomposition assumes first a light green color at the base, which gradually spreads over the whole organ. As a rule, the brain softens within two or three weeks, but a considerable time may elapse before the pulpy material which is seen in the brains of infants as a result of decomposition is obtained.

The above constitutes a group of the organs which undergo decomposition at an early stage.

The following organs decompose much more slowly: The heart may be found apparently sound weeks after death, and after well-marked decomposition of the organs already mentioned. The heart becomes soft first in the muscular projections in the ventricles; later in the walls, assuming a greenish, later a grayish-green, and finally a black color.

The lungs begin to show decomposition at about the same time as the heart. There are seen on the surface of the lung under the pleura small, various-sized projections filled with gas which have been caused by putrefaction. The color gradually becomes dark green and finally black. Later they become soft and their characteristic structure is lost.

The kidneys resist decomposition even longer than the heart and lungs. They gradually become soft and their color more brownish, later changing to dark green, and finally to black.

The urinary bladder withstands decomposition even better than the kidneys.

The esophagus will be found fairly firm long after the stomach and intestines have been decomposed.

The pancreas resists decomposition to such an extent that the body is putrid before changes are noticed in the organ.

The diaphragm may early show evidence of decomposition, but the process takes place so slowly that it retains its structure longer than the organs above mentioned.

The arteries and large blood-vessels are among the last of the organs to disappear.

The uterus is the last of all the internal organs to yield to decomposition. It is often found lying in place, fairly firm and in such a state of preservation that it may be examined, though the other organs are entirely putrid.

The muscles and ligaments withstand putrefaction still longer, and are only survived by the bones.

CHAPTER V.

MEDICO-LEGAL POSTMORTEM EXAMINATIONS

A medico-legal autopsy includes many details which are not included in ordinary postmortem examinations. Matters ordinarily of minor importance may be of very great importance. This is especially true of the external aspect and surroundings of the body. Much greater precision and thoroughness than is usually employed in cases of ordinary death from disease must be exercised. Further, the examiner must not lose sight of the fundamental object of the autopsy, namely, to assist in the conviction of one who committed a crime or to eliminate, so far as possible, this connection. Therefore, a medico-legal examination is far-reaching and exhaustive. Its purpose is, so far as possible, to trace the connection between the injury received, or any other agency, and the cause of death, carefully and accurately distinguishing the effects of natural causes from those which are abnormal. Further, the field is a much broader one than in ordinary postmortem examination, for the material that may be subjected for examination may include not only those who have died from disease, but also healthy subjects suddenly stricken.

A body cast up by the sea; mangled portions of bodies; bodies decomposed, both above and below ground; people who died a long time after the initial injury, etc., all these the medical examiner may meet with. Further, the examination is much more in detail in that every act of the medical examiner may later be subjected to cross-examination, and he must be prepared to hold to his opinion in spite of criticisms. Therefore, he must be thorough and alert, and must be on his guard lest he has forgotten or overlooked something. Freedom from bias is essential; fidelity and truthfulness are of paramount importance.

The View.—It is convenient to divide the medico-legal investigation into several steps: First, the view. In Massachusetts the medical examiner is required by law to "go to the place where such body lies and take charge of the same," etc. This includes not only the inspection of the body, but also its position and its surroundings. Here the medical examiner must exercise his best powers of observation; in fact,

almost play the part of a detective. At this time, also, identification of the body may be possible, and often this is easy from the attendance of relatives or friends, sometimes by papers in the pockets. But if identification cannot be obtained, he should make note of the following points in regard to the body: its sex; height; estimated weight; probable age; its development as to general health; peculiarities of the features; the type of nose; color of hair and eyes; length and thickness of the hair on the head; and, if the subject is a male, the condition of his beard and mustache; the condition of the teeth, especially if any are missing or show the result of dental work; also such marks as scars, tattoo-marks, etc.

Holding the Autopsy.—The autopsy should be held before visceral decomposition takes place, but not before the body has lost its animal heat. On the Continent the law requires that twenty-four hours shall elapse before autopsy, although inspection, of course, may be made at any time previous to that. The best time is from twenty-four to forty-eight hours after death. The time of day should be limited to daylight, and should not include artificial light. The time of beginning and of ending the autopsy should be noted. The attendants should be limited to one other medical man, and, if possible, to one experienced helper. The medical man will assist in making suggestions, taking notes, and may be of great assistance at the judicial trial. Other persons, especially relatives or friends and newspaper representatives, should be excluded. In homicidal cases the question as to whether the accused should be permitted to have a representative present is one that must be decided on its merits in each particular case.

Examination.—External.—The examination of the body itself may be divided into the external examination and the internal examination.

During the external examination the examiner will note the presence of rigor mortis and nutrition; the development of the muscular system; the amount of adipose tissue; the height; approximate weight, independent of the data mentioned above for identification. He will also make note of any lividity, its situation, extent, and appearance; also of the color of the skin. The subject should be rolled upon his face and the back inspected. Marks of violence, and other marks, such as those caused by dirt or blood, their exact situation and extent should also be noted.

The condition of the tongue should be noted, whether swollen or discolored. The pupils should be examined to see if they are dilated or contracted; also the corneæ and conjunctivæ should be looked at. The inspection of the region of the neck is also of much importance in this examination; yellowish-brown patches may lead to the suspicion of

strangulation. Therefore, the examiner should look carefully for excoriations, bruises, or other injuries.

Wounds, in their external appearance, are of very great medico-legal importance. First, it should be noted whether they are incised, punctured, contused, lacerated, or gun-shot. The location of each wound should be definitely determined, and this is done by reference to adjacent anatomical landmarks, such as the navel, ears, nipples, eyes, etc. The length, width and diameter of the wound should be measured accurately and never estimated. A photograph is of much assistance. The direction of the wound can be ascertained by the finger or catheter, but the depth is not determined by probing, but by dissection. If a weapon is at hand, which it is suspected caused the wound, the question to answer is, Could such a weapon cause the wound? It does not rest with the medical examiner to say whether this particular weapon did or did not cause the wound. The edges of the wound should be carefully inspected, and it should be noticed whether they are inflamed or not, and whether the skin adjacent is bruised, burned, or marked with powder grains, etc. Fractures of the bones should be examined as to their situation and severity, and it should be remembered here that internal hemorrhage may have resulted from rupture of an internal organ without any external sign of violence.

Internal Inspection.—Having completed the external examination and having made full notes of all important data, we proceed to the internal inspection, or autopsy proper.

Instruments.—The number of instruments necessary can be reduced to a very small limit, although, of course, an abundance is often convenient. The knife should have a blade three or four inches long, with a sufficiently large handle to insure a good, firm grasp; the blade should have a long edge, with a round point, and it should be sharp. A pair of strong scissors, a pair of dissecting forceps, small scissors, and, for the examination of the cranial cavity, a saw, chisel, hammer and hook, are all that is absolutely necessary. A clamp for holding the skull firm while sawing through it is of great assistance. A graduated measure holding at least one pint is also necessary. Minor accessories are needles, twine, sponges, rubber sheet, etc. Glass jars are occasionally required where it is desired to preserve more or less of the material.

While in ordinary postmortem examinations a systematic order of examining the various parts is pursued, in a medico-legal investigation the *injured part* or that which is the seat of the fatal lesion is generally the first to be examined; but if there is no suggestion as to where to begin, we must follow the methods pursued in clinical autopsies.

A preliminary *inspection of the abdomen* has probably already been made and any points noted.

Examination of the Thorax.—The first incision is from the top of the sternum to the symphysis pubis. The incision is carried through the peritoneum from the lower end of the sternum, and the chest muscles dissected away from the ribs; the sternum is divided from its inner attachments, that is, the anterior mediastinum, and then the sterno-clavicular joints are disarticulated, and the removal of the sternum with the adjacent portions of the ribs is accomplished.

The thorax exposed, we can explore the pleural cavities for abnormal conditions, to perceive the aspect of the anterior mediastinum, and to ascertain the presence of any adhesions caused by pleurisy. The pericardium is opened by an incision like an inverted Y, and the *heart* is exposed. The relative position of the heart and the relative fullness of its four cavities are noted before dissection of the organ itself; the size and general aspect of the organ, the amount of pericardial fluid, and the absence of pericardial adhesions. The cavities of the heart are then opened and the character of the blood therein observed. The efficiency of the valves is tested, both by inspection and manipulation, and with a stream of water. The color and general appearance of the heart muscles are noted, and the coronary arteries examined for arteriosclerosis.

The *lungs* are examined as to their color, volume, and density, punctate and other ecchymoses, the relative amount of blood in the tissue, edema, freedom of the pulmonary artery and its branches from obstruction by clots; also the presence of emphysema. The presence or absence of hyperemia of the mucosa of the bronchi, and the character of the exudate, if any, are noted.

The *tissues of the neck* are inspected and dissected, and, if necessary, the tongue, together with the trachea, are removed.

In the *abdominal cavity* before any of the organs are removed, one observes the peritoneum, its color, thickness, and freedom from adhesions. The colon is ligatured at the sigmoid flexure, and the small intestine is ligatured twice at the duodenum. The intestines can then be removed by an incision below the ligature at the sigmoid flexure and between the two ligatures at the duodenum. The gut is then opened throughout its length and its mucosa noted. In cases of poisoning, of course, this must be omitted at this time, and the gut left intact for purposes of chemical examination later, and the mucosa examined subsequently.

The left lateral ligament of the *liver* is divided and the organ removed with the gall-bladder adherent by separating the vessels. A ligature is then placed around the esophagus near the cardiac end of the stomach, and the esophagus divided, when the stomach can be easily removed, together with the pancreas and upper part of the duodenum. The

spleen is then removed independently. The stomach is opened along the lesser curvature, and its contents, color, consistence, amount, odor, etc., noted. In cases of poisoning it is occasionally advisable to delay this examination for the same reason that the intestines are not opened.

On the other hand, in regard to both of these organs, it may be said that with proper precautions to keep the contents from contact with other material and with due regard to their not being lost, an examination at this time may be desirable. It often occurs that the toxicological examination is not made for some time later, when putrefaction may have set in and destroyed, or at least brought about changes which may be confused with the appearance occurring as a result of the poison.

After the contents have been measured, the *mucous membranes* are examined.

The size, weight, color, density, surface, and edges of the liver should be noted. The condition of the gall-bladder and its ducts are also of importance.

Examination of the Pelvic Cavity.—The kidneys are then removed and examined with reference to their size, color, both on the surface and on section; the condition of the capsule, whether adherent to the kidney or not; the relations of the cortical to the medullary portions of the kidney, and the presence of cysts; also the ureters, especially their size, and the absence of obstruction in their lumen.

If the autopsy is performed upon a female subject, the womb, vagina, bladder, ovaries, tubes, and uterine appendages are removed together by dissecting away the connective tissue at the brim of the pelvis. The bladder is opened through the urethra and vagina by a lateral incision along its left side. The os uteri is uncovered by removing the vagina and bladder from the cervix; the depth of the womb is measured carefully; the uterine cavity is opened along the front of the organ and the ovaries examined with reference to their size, consistence, and the presence or absence of the remains of corpora lutea or other remnants of Graafian follicles. The tubes, ligaments, and rectum are also examined.

In the *examination of the head* the removal of the scalp is to be made by an incision from ear to ear, over the crown of the head. The scalp is then pulled back below the occipital protuberance and the anterior portion pushed forward over the frontal eminence. A short cut is then made through the skull, which passes in front of the frontal eminence and is carried laterally within an inch of the auditory meatus, and these cuts are joined posteriorly by another passing just above the occipital protuberance. The dura is inspected as to the amount of its injection; the meninges are also examined for this same condition, and also for the absence or presence of signs of inflammation. The convolutions of the brain may be suggestive of hemorrhage and compression re-

sulting therefrom. The cerebral lobes are then cut with long, sweeping incisions to examine the blood-supply. The lateral ventricles may disclose the presence of fluid. Any injury to the brain should be noticed and, if present, should be carefully measured if it is in any way connected with the cause of death.

Special Conditions.—There are certain conditions which may necessitate a postmortem examination, and about which a word or two more may be said.

Body Recovered from Water.—In case the body under examination has been recovered from water, it should be noticed whether there is grass, mud, or other material clutched by the hands; if the tongue is protruded; if any food, froth, or foreign matters are in or about the mouth, trachea, or bronchi; if the stomach contains much water; if the blood in the heart and principal vessels is fluid, etc. Marks of injuries that occurred after death should, if possible, be carefully differentiated from those which are antemortem.

In cases of strangulation or hanging the lividity of the face should be particularly noticed; the condition of the conjunctivæ, the position of the tongue, larynx, and the state of the blood, as to its color and consistence, and the heart as to its blood-supply. The marks of the ligature deserve special attention, and the occurrence of extensive extravasations in the tissues of the neck should not be passed by.

In cases where induced abortion is suspected and the patient is alive, evidence of recent delivery showing that she has undergone manipulation by instruments, and the recognition of symptoms from ingestion of so-called abortifacients should be determined. When in these cases the woman is dead, examination of the organs of generation should be particularly careful; there should be close inspection for marks of wounds caused by instruments and any appearance indicating inflammation or miscarriage.

In cases of infanticide, the maturity of the child, as to whether it was still-born or not; whether death took place before, during, or after birth, and whether its death was the result of natural causes, neglect, or violence; and whether the suspected woman shows signs of recent child-birth. In regard to the first, the following points should be noticed: the general aspect and development; the skin and its appendages, the hair and nails; the pupillary membrane, whether present or not; the length and weight of the whole body; the degree of ossification in the lower epiphysis of the femur, etc.

CHAPTER VI.

IDENTITY

The identification of a living person or of a dead body is not always an easy matter. Often the acquaintances and kindred of a living person may suffice to identify him. On the other hand, for some peculiar reason, and there are many, identification must be established by medical evidence.

Identification in General.—A person may be arrested for a crime and claim that a mistake was made in the identification. Habitual criminals are rearrested, and it is important to ascertain their identity. A person leaves home or country when very young and returns after a long absence to claim his rights or even property. Here the question of identity is of importance. A person may set up false claims to property, and here his identity must be established. When it comes to the identity of a dead body the identification is often even more difficult. Not only are the features and conditions often much changed, but the personal element of a living person is also lacking, such as his eccentricities and deficiencies. Identity is generally established by the age, sex, height, complexion of the individual plus certain physical peculiarities—marks on the skin, the remains of former injury, etc.

Identification is still more difficult as few people have correct powers of observation and description. One may maintain that a person's hair is dark and another maintain that it is light, so that it is easily seen that difference of opinion enters into this question, making its settlement more difficult.

A common method of disguise is the alteration of the HAIR, the manner of wearing it and its color. It should be noticed, if the person is a man, whether he is clean shaven or not, and, if not, how he trims his mustache or beard. The color of the hair may be materially lightened by bleaching with chlorin and hydrogen peroxid. This is, as a rule, easily detected on account of the unnatural brightness of the hair and the peculiar tints of color that are produced. Further, unless it is repeatedly done, the new hair close to the scalp will show the natural color. The hair may be darkened by the application of various dyes, most of which

contain some metallic base which forms a black sulphid, such as lead, bismuth, nickel or silver. In these cases of dyed or bleached hair generally the hair on other portions of the body is untreated, so that by a careful examination the fraud can be detected, although hair on other portions of the body, except in those persons having black hair, is generally of a slightly lighter shade. The natural color of the hair, except those having black hair, is a blending of several shades, all hairs not being exactly the same color; so that too much importance must not be placed upon the color of single hairs. Normal uninjured hair has a tapering end and is pointed, though, of course, this disappears if the hair has been broken or cut. Occasionally there is some peculiarity of the hair, such as a single lock being without pigment. This, of course, is characteristic of the individual, and may be the means of identification.

Scars are also an important means of identification. Scars which are caused by the loss of substance or by healing by granulation never disappear (Casper). As to the age of a scar it is difficult often to give an opinion. A fresh scar is tender, soft, and pinkish. Later (one to two months) it becomes harder and is no longer tender, finally becoming hard, white, and shiny. Thus one cannot say whether the firm white cicatrix is the result of a wound that happened six months or more previously. On the other hand, we cannot say that it may not have been received within a much shorter time; while we can draw much closer conclusions from a recent scar. As to the nature of the cause of the scar we can only form a rough opinion. It depends upon the healing whether it was by first intention or not, and whether it is upon a surface which is lax or tense. The scar may give information as to how it was received. A stab often leaves a triangular scar, although not always. Scars from bullet wounds are often depressed, with irregular edges and occasionally powder grains are seen in the immediate neighborhood. In these cases the means of exit are generally larger and more irregular than those of entrance. Vaccination is easily recognized by its irregular, flat, depressed scars. Blisters leave no scars unless injury was done to the deeper parts. As a person grows older the cicatrix becomes smaller, and though the cicatrix is permanent it may become more or less obscured, but can generally be easily brought out by friction or rubbing.

Tattoo-marks may be indelible or not, according as to how well they were done and what pigment was used. When well done with indelible pigments, such as India ink and indigo, they are permanent. It has been claimed that even indelible tattoo marks by proper means can be artificially removed. One case is reported by Tardieu of a man who removed tattoo marks from his body by acetic acid, lead, potash, and, finally, hydrochloric acid. Another case is reported where tattoo marks were removed by tannic acid and silver nitrate.

Birth-marks are often useful means of establishing personal identification. Moles, nevi, etc., are unalterable except by surgical interference and in these cases, on account of the usual attachment to the true skin, a permanent cicatrix would be left. Several cases are recorded in medical literature where identity has been established by means of these congenital marks, and the parties restored to their parents or to their legal rights. Other characteristics, such as lameness from congenital hip disease, club-foot, harelip, or the scars of an operation upon it, may be important means of identification. Supernumerary fingers and toes may also serve as a means of identification. Wens and warts have also served this purpose. Occasionally one iris is a different color than the other.

Identification by means of the papillary ridges at the bulbs of the fingers is one of the best ways of identification. These ridges differ to such an extent that they are practically individual for each person. They are unchangeable during life.

The vocation often aids in establishing identity. The chemist, photographer, shoemaker, etc., all have their distinguishing characteristics. Dressmakers' fingers may show roughening due to needle pricks. Clerks' hands may show callouses from holding pens and pencils. Washwomen show the effect of water and soap upon their hands, and many other instances might be cited where the trade of the person is easily recognized.

Identification of the Dead.—This may not be as easy as identification of a living person for numerous reasons. The victim may be away from home, where identification of personal characteristics or by various means above described may not be possible on account of the absence of acquaintances or kindred. Further, a body may have become so badly decomposed that identification is seriously interfered with.

If it is a case of identification of one who has recently died and before putrefaction has set in, the recognition of scars, tattoo-marks, birth-marks, or other peculiar characteristics, is, of course, of great assistance, especially in addition to recognition of the features. But recognition of the features is not by any means easy, even before decomposition has begun. Sometimes very trifling matters assist in identification, such as the label bearing the name of the maker of the victim's clothes, laundry marks upon the linen, or hat-bands, etc.

The hair is of great importance in identification, especially in cases of homicide. In these latter cases we may find hairs upon the weapon that was used or upon the clothes of the accused, which may be those of the victim.

Draper reports a case from Wharton and Stillé's "Medical Jurisprudence" showing the value of this evidence: "A little girl, nine years old,

was found dead in a field. There was a gash in her throat, and suspicion fell on the mother, who was arrested. It was observed that she was very cool. She stated that she had been out with her little girl near where the body was found and had been separated while looking for flowers. She denied all knowledge of the manner of the child's death. A long, sharp knife was found in her possession, and this was examined carefully and nothing was found on it except a few small hairs adhering to the handle and scarcely to be seen. When her attention was called to this hair, she said at once: 'Yes, I daresay there is hair on the knife, and very likely blood, for as I came along home I found a rabbit caught in a snare, and I cut its throat with my knife.' The knife was sent to an expert in microscopy to determine the origin of the hairs and their identity. Without any knowledge of the facts he said that the hairs were from a squirrel. And they corresponded with those of the squirrel fur tippet on the child's neck. The mother confessed her guilt."

The teeth may be a means of identification of the living as well as of the dead; their shape, regularity, and peculiar characteristics, such as the operations of the dentist, go to make them important evidence in many cases.

Where the remains have been mutilated and the body more or less dismembered the identification is then much more difficult. Here, medical advice is often of great assistance. A careful adaptation to each other of the various parts that have been recovered may assist in determining the probable age, height, and weight of the victim. It may also assist in the determination of the sex. Often, though, in these cases some important part of the body is missing, such as the head, which may throw some doubt on the identification. On the other hand, though the head may be unrecognizable as such on account of its mutilation, characteristic parts of it, such as the teeth, may be found and may help in its identification. Occasionally a piece of clothing or an article of ornament, such as rings, earrings, metallic buttons, may be found, which will be of assistance.

Where bones or portions of bones are the only material at hand, the identification becomes much more difficult, and often the best the medical examiner can do is to say that it is consistent with being such and such a person. He cannot say definitely that it is the person in question. When one has the whole skeleton it is easy to say whether it is he or not. The bones may have been buried for some time, how long it is often impossible to say, even roughly, although we know that the bones decay very slowly. The teeth are a good deal of help in trying to fix the age of the victim. As to its height, if the skeleton is entire, 7 to 7½ inches may be added for the soft parts and the vertebral cartilages. Another

method which is not exact, but will give approximate results, is to measure the distance from the tip of one middle finger to the other with the arms outstretched. The most exact way is to accurately measure the parts at hand, and to estimate the size of the missing parts, making a proper allowance for the soft parts. The skull will often determine whether the victim was Caucasian, Mongolian, or African.

In connection with these various points careful inspection should be made as to the presence of deformities or mechanical injuries, and as to whether influences other than those of natural decay have exercised any action upon the bones.

Tidy's scheme of the details to be noted in the identification of a body, whether living or dead, or of the bones alone, may be of some assistance:[1]

GENERAL EXAMINATION OF THE RECENTLY DEAD BODY

Surroundings of the Body.—Clothes; jewelry; all articles on the body or in the coffin; hairs grasped in the hand or free about the body.

Probable Business or Trade at which the Person Worked.—Hands; injuries to the nails; stains.

Height.

Weight.

Age.—Amount and color of the hair; teeth; the alveolar processes; the fontanelles; the points of ossification; condition of the epiphyses; the size of the bones.

Sex.—Genital organs; breasts; general conformation; length of hair, especially the back hair; the pelvis; markings on the bones.

Deformities.—Hip-disease shortening; spinal-disease curvature; talipes, wens, etc.

Marks, Growths, etc., on the Skin.—From disease—scrofula, syphilis, small-pox, skin diseases; surgical operations; tattooing; natural causes —moles, nevi, warts, pigmentations; from violence; from stains of blood, etc.

DETAILED EXAMINATION OF THE VARIOUS PARTS OF THE BODY

Head.—Note complexion, whether fair, dark, or sallow; shape and race type; the forehead, whether low, high, or prominent; eyes—large, small, color of iris, sunk or prominent; nose—short or long, flat, state of nostrils; ears—lobules, if pierced; mouth—large or small and if scarred in the roof; lips—large, small, or scarred; teeth—number, regularity, decay, false; chin—full, round, double, pointed, or receding; hair—amount, color, length, if natural or artificially colored, if recently cut.

Neck.—Whether long or short, thin or fat; scars.

Chest.—Formation; shoulders; sternum.

Pelvis.—Genitals, if normal or otherwise; in females, the question of pregnancy; if a skeleton only, whether male or female.

[1] Tidy. "Legal Medicine." (Quoted by Draper.)

Extremities.—Arms—size and length; hands—roughened or hardened by work, or stained; fingers—short or long, nails; legs, if equal in length; ankylosis of joints; bowed; in-kneed; the ankles and feet.

Mutilated Remains.—Note the degree of accuracy with which the parts fit together—bones, muscles, blood-vessels.

Nature of the Mutilation.—Whether the muscles were hacked or divided by a sharp knife; whether the bones were chopped or were divided with a fine or coarse saw.

After-treatment of the Parts.—Whether by time or by chemicals; by burning (examine ashes for phosphate of lime); or by boiling.

Discovery of a Skeleton or of Individual Bones.—Note the extent of the disappearance of the soft parts; the extent of the separation of the bones; the color of the bones; their state of preservation; are they human; sex—note the pelvis especially; do the bones belong to the same body; are any fetal bones in or near the pelvis; have any remnants of disease been left on the bones; were there any injuries of recent occurrence before death.

CHAPTER VII.

SEX AND AGE

SEX

The term "hermaphrodite" is used, strictly speaking, to describe the condition existing in one person of the presence of the organs of both sexes. Generally, however, it is applied to those cases where there is some doubt as to the real sex of the individual on account of some deviation from the normal type of genital organs. The true hermaphrodite may be considered as capable of self-impregnation, but no such case can be found recorded, and we will use the term in the broader sense.

The cause of this change from the normal type is found in the early stages of embryonic development, and it need not concern us here. It is often impossible to differentiate sharply as to the true sex. It is especially true in cases of children as the genital organs are not fully developed and local signs are lacking. In doubtful cases we can give only an approximate opinion, and even postmortem, a positive opinion may not be possible even after a most careful anatomical examination. The term "pseudohermaphrodite" is used to describe those cases of doubtful sex where evidences of both sexes are present, but one of which predominates.

Many of the so-called hermaphrodites have only apparent deviation from the normal type. The internal organs have their natural development, and the abnormality is only external. Male hermaphrodites may exhibit a more or less developed penis with the urethra normal, or opening at variable distances between the glans and pubes. The scrotum may be cleft, presenting a resemblance to the vulva, but there is no suggestion of a vagina, although there may be some slight depression. In these cases the testicles are on either side of the divided scrotum. There are many cases in medical literature of reputed hermaphrodites. Males with such malformations are not necessarily impotent. The apparent absence of the testicles from the scrotum may be the only evidence, and these may have remained in the abdomen instead of descending as is normal. In these latter cases, if the testes are healthy, they are not impotent.

Female hermaphrodites are more numerous on account of the doubt that arises as to their sex owing to the unusual size of the clitoris. The person exhibits more or less masculine traits, such as a varying amount of hair upon the face, which may even attain to the appearance of a beard; the voice is deeper and more masculine, and the development and action also. The sex instinct is usually more pronounced in them. The clitoris of the adult female is about one-half inch in length, but there is one case recorded of a girl, seven years old, who had a clitoris one inch long, and another case where it was two inches long. Where this hypertrophied condition of the clitoris exists the urethra shows usually more than one opening, and the vagina is often so constricted that it is almost imperforate. Such individuals exhibit unnatural sexual desire, and are often guilty of unnatural crimes. Many such female hermaphrodites have lived as men, following a trade, bearing a man's name, and even being married as men.

A case reported by Badaloni[1] is of interest from a medico-legal point of view. The husband sued for divorce from Maura Faustina, who, he maintained, was a male acting as his wife. The husband testified that his wife associated with other women, and that he was ridiculed by his acquaintances. The divorce was granted and then Maura demanded of his brother one-half of the property of their deceased father on the ground that he (Maura) was a male. The brother denied this and brought a countercharge that his wife had been seduced by his erstwhile sister.

As has already been mentioned, the existence of true hermaphrodites has been doubted, and it is extremely improbable that true cases have existed. It is possible that one person might have the generative organs of both sexes—that is, the ovary of the female and the testicle of the male; the generative passages—that is, the tubes, ovaries, and vagina of the female, and the vas deferens, seminal vesicles, prostate, and efferent vesicles of the male. The coexistence of the organs of both sexes is termed true glandular hermaphroditism, and the coexistence of the generative passages true tubular hermaphroditism, according to Guéricolas.

Mixed cases, where the external organs are of one sex and the internal of the other, are few, and cannot properly be called hermaphrodites. One such case has been reported of a person, sixty-two years old, who had lived and been married as a male. The external organs consisted of a penis with the orifice of the urethra at the base of the glans, and an empty scrotum. The internal organs were completely feminine, and in addition there was a prostate in its normal position.[2]

[1] Wharton and Stillé's "Medical Jurisprudence," Vol. III, 5th Ed.

[2] *Ibid.*

Instances of true tubular hermaphroditism are not uncommon in medical literature, though, of course, they are rare in ordinary medical statistics.

Cases of glandular hermaphroditism are far more rare, if indeed they ever do occur. Several cases have been considered as such, but the condition was not proved postmortem, and the authenticity is doubtful.

One such case was reported by Heppner:[1] The subject was a premature infant who lived six weeks. At the time the case was considered one of false female hermaphroditism. Heppner investigated the material carefully ten years later and reported as follows:

The external organs consisted in a hypospadiac penis, a scrotum which was empty, and urogenital canal opening just below the penis. Into the anterior part of this canal opened the urethra, and into the posterior part, the vagina. The urethra led into the bladder and was surrounded by the prostate. There were no seminal vesicles.

The internal organs were represented by a uterus with a prominent cervical portion protruding into the vagina, and in every way normal. To it were connected the two Fallopian tubes, which were permeable, and opened into the peritoneal cavity by fimbriated ends, as normally. In the usual situation were the two ovaries, the left 13 mm. long, the right 17 mm. long. Just below the internal ends of the two ovaries were two other bodies representing the testes, the left measuring 7 by 4 by 2 mm., the right 5 by 4 by 2 mm. Just above the left testicle was a group of glandular ducts, sixteen or seventeen in number, with an external aspect like that of the organ of Rosenmüller. These ducts formed a compact mass at a little distance from the testis, and extended toward that organ, perhaps half of them being traceable directly to the testis. On the right the organ of Rosenmüller was situated between the ovary and the testis, but was not quite so well developed as on the other side. It could be recognized as composed of tubes closely united, but it could not be determined whether the tubes in the middle of the organ led to the ovary or to the testis. The round ligaments of the uterus arose from the angles of the uterus, and, crossing the ureters, led to the inguinal canals. The microscopical examination of the ovaries demonstrated the presence of ovisacs and Graafian follicles; that of the testes showed the tunica albuginea, the fibrous septæ, the glandular tubes—caniculæ—filled, lined with cells of variable volume, containing granular protoplasm, and generally with a distinct nucleus. In the lumen of the canals were numbers of nuclei, completely filling the tubes, but there were no cells like those in the walls. In the net-work of ducts, which had a much smaller caliber than the seminiferous canals, the nuclei were agglomerated in masses and arranged longitudinally.

But in this case Pozzi reexamined the glands near the ovaries, and, while confirming Heppner's conclusion to a certain extent, considered these glands so rudimentary, especially in view of their small develop-

[1] Wharton and Stillé's, "Medical Jurisprudence," Vol. III, 5th Ed.

ment that it was impossible to distinguish whether they were testes or ovaries, and, therefore, some doubt was thrown upon even this case.

Theorizing as to the possibility of the existence of true hermaphrodites is hardly a subject for a book of this scope, and, in view of the difference in opinion as to the embryonic development, hardly worth while.

In conclusion we might say that the determination of sex in a living person presenting abnormal conditions of the sexual organs may be attended with difficulty, as the external and internal alterations may not be consistent. The general appearance and habits of the individual will assist us but little, and also the manner and mode of life, for a person may be sincere in his or her belief as to the condition present. Occasionally it may happen that the question can be settled only by the sexual predominance of the external organs.

The absence of sexual organs is generally confined to those persons where the external organs are lacking or are only very rudimentary. There are no authentic cases of the absence of the internal generative organs.

The Determination of the Sex of the Skeleton

The determination of the sex of the skeleton may be an important fact. The male skeleton averages in weight about 10 pounds and 6 ounces and the female about 8 pounds and 13 ounces. The bones of the female skeleton are generally more delicately made than those of the male; their development is less marked, and the ridges for the muscular attachments are smaller. Their flat bones are thinner and the round ones more spongy. On the other hand, the male bones are larger, stronger, and more rugged, and their ridges and projections are larger and rougher.

The skull is generally smaller in females and the facial development less marked; the jaws are less prominent and the frontal sinuses smaller. The transverse diameters and the mastoid processes are smaller. The thorax is shorter and narrow at the base and more or less oval in shape, while in the male it is more conical. The spine is relatively longer in the female than in the male. The ribs are lighter and are inclined downward at a sharper angle.

The sternum is lighter than in the male, and Hyrtl says that the manubrium is longer than half of the body (middle piece), while in males it is less than that. This is considered by him almost infallible evidence of sex. The clavicles are shorter, straighter and lighter in females than in males. The scapula is relatively lighter in females, its angles are sharper, and it is generally thinner and shorter. The femur is often useful as an aid in determining the sex. The angle be-

tween the neck and shaft of the femur is of little value in the determination of sex, though it was formerly considered diagnostic. Anteriorly, the male femur is narrow at its lower portion, while the female femur is narrow above or at its middle point. The pelvis more than any other part of the skeleton gives evidence of the sex of the individual. In the male it is larger and heavier than in the female; its ridges for the attachments of muscles are more prominent, and its development is stronger; and it is narrow and deep, the ilia having a more or less vertical direction. The distance between the anterior superior spines is between 19 and 21.5 cm.; the greatest diameter is the bilateral; the ridge is perpendicular and the promontory of the sacrum projects more. The tuberosities of the ischia are nearer together and the pelvis is round. In the female the pelvis is broader, the ilia flare outward, and all of the diameters are greater. The anterior superior spines are between 35.5 and 36 cm. apart; the greatest diameter is the anteroposterior one; the symphysis is lower and the promontory of the sacrum not prominent. The pelvis is oval and the cavity deep. The sacrum is broad and triangular and strongly curved below.

AGE

The age is often of great importance in legal controversy, and its determination may often be accomplished by medical evidence. The law recognizes no different stages in fetal development, and further questions of law, as to whether a dead fetus is the dead body of a person or not, we cannot consider here. We will confine ourselves to the age after a child is wholly born.

The determination of the age of the new-born rests almost wholly on the observation of the changes which occur in fetal structures that are no longer useful. Changes in the funis may be of assistance on this point. For a few hours after birth the umbilical cord is bluish, twisted, full, moist, and glistening, and about the size of the adult finger. The luster disappears in twelve to twenty-four hours, the cord becoming transparent and changing in color to a yellow. After the fifth day, the drying is usually complete. Meanwhile the navel shows evidence of separation and a line of demarcation appears. In about a week this is completed and only a small surface remains to be healed. In the majority of cases the separation of the cord is observed on the fifth or sixth day; it may occur as early as the fourth or as late as the ninth. The healing of the navel is usually complete by the end of the second week, often in ten days. The weight of the child generally falls during the first few days of life, but by the tenth day the loss has generally been recovered, and after this time there is progressive increase, so that

at the end of the fifth month the child weighs double what it did at birth, and at the end of sixteen months it weighs four times as much.

The examination of the teeth and of the mouth will often assist us in forming an opinion as to the age of the child. The two lower middle incisors generally appear before the end of the seventh month. The four upper incisors appear through the gums between the ninth and middle of the eleventh month, and in addition to this we will find at the end of the first year the two lower middle incisors and the four anterior molar teeth. The four canine teeth generally appear between the age of eighteen and twenty-one months. The four posterior molars appear between the twenty-sixth and thirtieth months. During the sixth year beside the twenty teeth already mentioned, there are present in the alveoli the twenty-eight teeth of the permanent set; so that we may find forty-eight teeth at this age in a child's jaws.

The permanent teeth appear at the following ages: the anterior molars, six to eight years of age; the four middle incisors, seven to eight years; the four lateral incisors, eight to nine years; the bicuspids at ten years; the canines, eleven to thirteen years; the second molars, thirteen to sixteen years, and the last molars, or wisdom teeth, at about the twenty-first year.

The posterior angle of the lower jaw at birth, on account of the absence of teeth is about 140°. The outline of the jaw is almost semicircular, is shallow, and consists chiefly of the alveolar portion. During growth the jaw increases posteriorly, so that the posterior angle by the time puberty is reached is about a right angle and the outline is more concave than semicircular.

As the age develops other characteristics mark the growing child. In the male the voice changes, the genitals develop, hair appears on the pubes, and a beard upon the face. In the female there is noticed fullness in the chest, changes in the pelvis, the appearance of hair on the pubes and in the axillæ, and menstruation appears. This arrival at puberty varies widely in different individuals. It may appear at twelve in the male or be delayed until eighteen in either male or female. Full growth is not obtained until about the twenty-fifth year of age in the male and the twenty-second in the female. So many items enter into the consideration, how old is the subject? that it is almost impossible to form more than a guess.

Old age is marked by flabby muscles which are slow to respond to the will. There is stiffening of the joints; the teeth are either decayed or entirely lost, and there is loss of the color and quantity of the hair.

In old age the bones become yellow, more brittle, and lighter in weight; their processes and ridges are less pronounced; the various

cartilages become ossified; the pelvis is a single bone, and there is often marked atrophy of the facial bones.

An approximate determination of the age of a skeleton may often be necessary. If the epiphyses of the long bones are not ossified the person is under twenty. If the important epiphyses are firmly united and the secondary epiphyses still distinct, the age of the victim was probably between twenty and thirty, especially if the union of the first sacral vertebra with the others is delayed. The ensiform cartilage generally becomes firm at about the twentieth year of age; also the coccyx is ossified and united with the sacrum; the ribs and costal cartilages are strongly united, and the cranial sutures closed. Some assistance may be derived from the teeth, as previously described.

CHAPTER VIII.

DEATH BY ASPHYXIA

Hanging.—Hanging consists in the suspension of a person by a cord or other means or constriction around the neck whereby the weight of the body exerts sufficient traction on the cord to cause very quickly loss of consciousness, arrest of respiration, and death. The weight of the body may be brought into it as a factor either by removing the support from beneath the victim or by raising the victim from where he stands. In the execution of criminals the support is removed from beneath the victim, and the body drops until suddenly checked by the rope.

The cause of death may be either suffocation due to shutting off the air to the respiratory organs, or to disturbance of circulation of the brain where the vessels of the neck are compressed, or it may be due to injury of the spinal cord, caused by dislocation or fracture of the cervical vertebræ. This latter is the usual condition in judicial cases. Pressure upon the pneumogastric nerve may play an important part in producing death by hanging. Death by hanging may not be due to asphyxia alone and may be caused in spite of asphyxia.

Dr. Reineboth reports a case where tracheotomy was performed upon a man and a canula introduced to enable the man to breathe, but the patient was able to commit suicide by hanging, with the noose above the opening of the canula; so that there was no interference with respiration. Death appeared to take place rapidly, and probably as a result of unconsciousness and subsequent inability of the victim to rescue himself. Postmortem, the cerebrum was found anemic; there was fullness of the arteries at the base of the brain and hyperemia of the pons and medulla, but there were no signs of asphyxia.

Generally in cases of hanging the rope is between the larynx and the hyoid bone, and Hofmann states that death is due not to compression of the larynx, but to obstruction of the pharynx.

The SYMPTOMS of pressure upon a carotid are cyanosis, dizziness, fainting, followed by unconsciousness, and later spasmodic contraction of the muscles and an increase in the blood-pressure and in the pulse-

rate. Unconsciousness undoubtedly in many cases comes on immediately, although death may not ensue for some time later.

Tidy divides the phenomena of hanging into three stages: There is first a partial loss of consciousness, with stupor. The initial symptoms which are described by those who have recovered are intense heat in the head, brilliant flashes of light before the eyes, deafening sounds in the ears, and a heavy feeling in the lungs; ineffectual efforts to breathe are often made after the air-passages are closed; this stage may last from thirty seconds to three minutes; there is probably no pain endured by the victim during this stage.

In the second stage the victim is entirely unconscious, and convulsions usually occur, though they may be entirely lacking. The urine and feces are expelled in this stage, if at all. The hands are clenched and the diaphragm and intercostal muscles act spasmodically, and there is twitching of the lower limbs.

In the third stage the only sign which shows life is the heart's action. This may be observed for ten minutes after the "drop" but there are occasional exceptions.

Tardieu reports a case where the heart beat at the rate of 80 per minute for an hour and a half after the man was supposed to be dead.

The duration of the hanging sufficient to cause death varies to a considerable extent. As a rule, resuscitation is not possible after five minutes' suspension. The situation of the noose may not be such as to prevent absolutely respiration and may prolong this time. Other circumstances as to whether the noose tightens above, across, or below the thyroid, the length of the fall, the weight of the person, and his powers of resistance are to be considered. Death is more instantaneous when damage is done to the spinal cord. This is always attempted in cases of judicial execution. If a sudden twist is given when the body drops fracture of the vertebræ is more likely to occur, and death come on quickly. Dislocation of the spine is most easily accomplished by placing the knot under the chin. Resuscitation is very difficult, and impossible unless there is only very slight injury to the neck, and the more severe symptoms of coma have not supervened.

The TREATMENT for resuscitating a person from suspension is to cut him down and to remove all tight clothing, especially from around the neck and chest. Cold affusions may be made to the head and chest; coughing or sneezing may be induced by ammonia or other stimulants; friction of the limbs, hot applications and blankets, and the subcutaneous injections of brandy or ether are often useful. The indications are to keep up the respiration, or to restore it if not present; to keep the heart going; to relieve the congested blood-vessels, and to keep up the bodily warmth.

Postmortem appearances may be divided into the external and the internal. Externally, where the death was due to asphyxia principally, the lividity and facial expression may be that of simple suffocation, but more often the face is not congested, the eyes are not prominent, and the tongue does not protrude beyond the teeth. The neck may show evidence of ruptured muscles or fractured or dislocated vertebræ by the irregularities in its contour. The most significant external evidence is the mark of the cord itself upon the neck. There is almost always some impression. The furrow around the neck may be either single or multiple, depending upon the number of turns of the rope. Where there are several loops of the rope around the neck there will be several lines lying parallel to each other. Where other material than rope has been used, such as bedding, pillow-cases, stockings, etc., instead of a sharply defined, distinct line, there will be a constriction of varying width, and the indentation is not marked. The direction of the rope should be carefully noted, in order to differentiate hanging, which is more often suicidal, from homicidal strangulation. In the former the direction is upward toward the point of the knot; whereas in strangulation the line, as a rule, goes directly around the neck. The course of the noose is usually between the hyoid bone and the angle of the jaw although it may be lower down. Dislocation and fracture of the hyoid bone, fracture of the laryngeal cartilages, and dislocation or fracture of the cervical vertebræ may occur, but rarely in suicidal cases. Rarely, also, does decapitation by the rope occur, and so far as is known this has never occurred suicidally. The position of the head has some value as a sign of suspension during life. The most common position is a marked flexure forward, the chin resting on the front of the upper portion of the sternum. The head is also found inclined away from that side on which the knot is. This forward and lateral inclination may be considered typical, but if the knot remains under the chin the head will be pulled up and backward, with marked flexure of the posterior portion of the neck. Saliva sometimes falls from the corners of the mouth, and by some authorities this is regarded as a sign of value that the body was suspended during life, as it cannot be produced in a dead body.

The appearance and evidence of genital excitement is sometimes observed upon the bodies of those dying by hanging, but they are of no diagnostic significance as they are found in other forms of violent death. The internal coat of the carotids is often ruptured, especially in old people.

The differential diagnosis between suspension before and after death is of great importance, as people have been murdered and their bodies hung up to simulate suicide.

Accidental suspension is rare, although it has occurred; but these cases are generally so easily determined that they need not concern us here.

Homicidal hanging is no doubt rare. It presumes great inequality of strength and energy in the two parties, which is always presumed to be in favor of the assailant. Therefore, in homicidal hanging the victim is generally a child or a woman or one much exhausted by disease or other cause. Or he may be drunk, or unconscious, or otherwise incapable of defense; or he may be overcome by inequality in numbers, as in lynching. In these cases evidence must show violence and struggling, as it cannot be supposed that murder or hanging could be performed without some resistance on the part of the victim or some violence on the part of the murderer. The injuries especially suggested are scratches and bruises on various parts of the body, dislocations and fractures, especially of the fingers, and ecchymoses about the head and back. Sometimes the victim is first strangled and then suspended, but in these cases the chances are that there would be the marks of the fingers or cord upon the throat. The situation of these indications must be such that the person could not have readily produced them himself, and a decision that homicide has been committed must not be made without taking into consideration that many of the above injuries may have been self-inflicted, as well as the suspension.

In the case of discovering the suspension of a dead body, it must be noticed if there are indications that the body was strung up so that the feet are clear of the floor or other support. While it is true that homicide by hanging may be made to simulate suicide for purposes of concealment, on the other hand suicides occasionally feign the method of homicides to create this suspicion. Such a case has been reported by Heinrich. A woman's body was found hanging from a branch of a tree; her feet were clear of the ground; decayed leaves were in her mouth. A paper pinned upon her dress had written upon it, "Three of us committed the murder. We found on her one thaler and fifteen groschen. She only prayed for her two children." No marks of violence or anything suggestive of a struggle was found on or about her. The decision after a full investigation was that death was due to suicide.

Postmortem appearances after death by hanging may be described by an abstract from the official report on the body of Guiteau who died by judicial hanging in Washington, D. C., for the murder of President Garfield.[1]

The body, which was of a faint yellowish tinge, was that of a man about 5 feet 7 inches in height, and weighed 145 pounds. Examination

[1] Draper, "Legal Medicine."

of the eyes showed the pupils were slightly and equally dilated; the vitreous was cloudy and the fundus indistinguishable; the conjunctiva of the left eye was congested. Two hours later an appearance as of transverse fracture of the lens was noticed. There was a yellowish furrow, a few lines in width, extending around the neck downward and forward on a line with the rope. On dissection, the sterno-cleido-mastoid muscles were found to be ruptured about half way between their points of origin and insertion. The thyro-hyoid ligament was also ruptured and the hyoid bone and the thyroid cartilage were widely separated. The large blood-vessels of the neck were engorged, and there was neither fracture nor dislocation of the vertebræ.

The pia mater was anemic anteriorly, and posteriorly there was slight hypostasis. The cerebral vessels appeared to be normal in all respects. There was no roughening of the inner surface of the skull. The brain was firm; its weight, including the cerebrum, pons and medulla, and a portion of the dura was 49½ ounces; the *white substance* was almost absolutely anemic.

The usual median incision was made and the abdomen opened. There was extravasation of blood in the right pectoralis major muscle, near the second rib. The adipose layer of the abdominal section was one inch in thickness; the dome of the diaphragm extended up to the fourth rib on each side. There were old pleuritic adhesions at the apex of the right lung; the upper and middle lobes were congenitally united by connective tissue; the lung was normal throughout; there were also old pleuritic adhesions of the left lung to the diaphragm and between the lobes. The heart weighed 10¾ ounces; its muscular substance was apparently normal; there was an abundance of fat on its anterior surface and a villous patch of old pericarditis. Near the apex of the right ventricle the valve contained a little blood, just forming a clot. The valves were normal. The aorta was slightly atheromatous for a short distance above the valves. All the abdominal viscera presented large accumulations of fat; they were normally situated. The liver was congested. The gall-bladder contained a little bile. The spleen was lobulated and enlarged and weighed 18 ounces, the capsule was bluish, the substance brown; the Malpighian bodies were hypertrophied. The pancreas was normal. The stomach contained food. The intestines appeared normal and were not opened. The kidneys were congested.

Strangulation.—Strangulation is the compression of the neck in any form or manner, not necessarily with a rope, and without the weight of the body entering as a factor in any way; while hanging is constriction of the neck by a ligature, and the weight of the body is the effective force by which the constriction produces fatal results. Death by strangulation may be caused by throttling, or manual strangling, and secondly by means of a ligature, such as a rope. This latter form is by far the most common.

In manual strangulation pressure is made upon the trachea or larynx, both laterally and from before backward against the spine. The back of the neck is held against some resisting surface, or by the assailant's

other hand, making counterpressure; thus the air-passages are closed. Pressure is also often from below upward, thereby forcing the chin against the palate and pharynx. This is the usual method of "garrotting" as employed by highwaymen with intent to rob. It is the customary method of putting criminals to death in Spain, unless they are shot. In Spain a brass collar is fitted around the victim's neck and, by means of a screw at the back, pressure is exercised upon the air-passages, and at the same time the pointed end of the screw pierces the spine, and death is instantaneous. In addition to the obstruction to the air-passages, interference with the circulation in the vessels of the neck, and the consequent congestion of the brain hasten a fatal result. But these are more important where the strangulation has been accomplished by a rope or band around the neck.

In so-called manual strangulation closure of the glottis is the most important factor. Here pressure upon the vagus nerve may cause a sudden stopping of the respiration, which, if continued, is quickly followed by death. Temporary unconsciousness may be caused by this means and without resistance or struggle on the part of the victim.

In strangulation by means other than the hands, such as by a rope or cord, handkerchief, strap, ribbon, or some article of dress, as a stocking, the ligature may be wound around the neck several times and then drawn taut, or it may be wound only once, pulled taut, and twisted like a tourniquet with a stick or some such means.

The position of the constricting force, whether the hand or a rope, is important. When around the cricoid cartilage it produces unconsciousness much more quickly than when placed elsewhere. If it is placed over the larynx it is more rapid than when placed between the jaw and hyoid bone. Other things being equal, the greater the force, the quicker the fatal result.

The SYMPTOMS are divisable, according to Draper,[1] into four stages:

The *first* is a longer or shorter preliminary stage in which there is simply a suspension of breathing; it continues for less than a minute until the demand for air is imperative and irresistible.

The *second stage* is one of resistance and excitement, and lasts until unconsciousness sets in. It is accompanied by violent efforts to breathe; the countenance shows distress and the hands are clenched; the tongue may be caught between the teeth and bitten; the urine and feces may be discharged, and there is great struggling.

The *third stage* is characterized by unconsciousness, with irregular involuntary spasmodic action of the limbs; the convulsions may even exhibit opisthotonos; the superficial veins are swollen; the face livid, and sometimes hemorrhage occurs from the nose, lips and ears.

[1] *Loc. cit.*

The *final stage* begins with the cessation of spasms and efforts to breathe; the victim is quiet and the heart's action is persistent.

Dr. Hammond, of New York, tried some experiments to determine whether or not strangulation was painful. Seated in a chair, a towel was placed around the doctor's neck, one assistant twisting the towel, while another assistant watched the effects and took notes.

After the experiment Dr. Hammond said: "I first noticed a sensation of warmth and tingling beginning in the feet and passing quickly over the entire body. The vision partially disappeared, but there was no manifestation of colored lights. My head felt as if about to burst, and there was a confused roaring in the ears. I suffered no loss of consciousness and was able to tell my friend whether I felt pain from the knife thrusts which he was inflicting on my hand. In sixty-two seconds from the beginning of the experiment all sensibility was abolished. After a few minutes' rest, a second trial was made in the same manner as before. This was followed by symptoms like those described above. Sensibility ceased in fifty-five seconds, and a stab with the knife sufficiently deep to draw blood caused no sensation whatever."

The LENGTH OF TIME that is required for a fatal termination is of some interest. Violent and sudden constriction of the trachea renders a person unable to call for help, and may cause almost immediate insensibility and death. The method of application of the constricting force is of some importance in this connection. The use of the tourniquet would probably be followed by almost instantaneous death. Manual strangulation may also be followed by almost immediate fatal result. Where the strangling is accomplished by a rope or cord drawn tightly around the neck, but not twisted, the interruption to the entrance of air is not so abrupt, and death takes place more slowly. The old, the very young, and those incapacitated by disease or other physical weakness, of course, offer less resistance than one in full possession of his faculties and strength and perish more readily.

Tardieu mentions the case of an old woman who was strangled so suddenly and quietly that her husband, just the other side of a thin partition, was unaware of it. Finally, we may say that death will follow in from three to five minutes if the compression or constriction of the neck is uninterrupted.

POSTMORTEM APPEARANCES.—The external appearances may be those of asphyxia; that is cyanosis, staring eyes, protruding tongue, and ecchymoses under the skin of the neck. But, as a rule, the face is pale or livid, the eyes are not prominent, the tongue is not protruded beyond the teeth, and the frothy mucus on the lips is not in large amount.

The most characteristic signs are the external signs found in the region of the neck. If the constriction was performed by manual pressure,

then there will be the finger-marks on the sides of the neck, which can often be clearly enough made out to tell how the hand was placed. If the assault has been made from the front and with the right hand then the finger-marks will be upon the left side of the victim's neck, the marks of the thumb on the right side, generally under the angle of the lower jaw. The color is at first red, then violet or bluish, like other ecchymoses. There may also be excoriations, and the directions of the imprint of the nails, their width and depth, are of importance as diagnosis, and also as evidence concerning the manner of the struggle, which hand was used, and the degree of resistance. Occasionally the traces left by the fingers are so slight as to be easily overlooked, and severe injuries to the deeper parts may have occurred without very marked external evidence. Cases are recorded where the cricoid cartilage, thyroid cartilage and hyoid bone have been seriously injured, if not fractured. Of course, these mean the application of great force.

Generally the marks of constriction, where a rope or other means was employed, run more or less transversely around the neck, the width of the band in these cases varying according to the size of the string, rope, or other medium used. If the rope was wound around the neck several times there may be a number of grooves and ridges corresponding to the number of turns. The color of the groove of the rope may be either dusky or purplish, or may even be without discoloration, the edges more or less livid or reddened. The situation of the groove depends, of course, upon the position of the constricting cord; it is usually below the larynx in front.

Internally, the most important lesions are in the deep tissues of the neck; there is effusion of blood between the muscles, around and into the larynx and trachea, and within the sheaths of the large cervical vessels. Fracture of the larynx, trachea and hyoid bone are also quite common. The interior of the larynx is often congested, and the trachea may contain frothy, blood-stained mucus. As mentioned above, the external appearances and ecchymoses are no indication as to the severity of the injury to the deep tissues of the neck. Even where, on inspection, there are no ecchymoses, infiltration and extravasation of the blood have often been found in the subcutaneous connective tissue. Sometimes these extravasations are circumscribed and isolated, corresponding to the surface marks of the fingers; at other times they are more diffuse, the blood infiltrating through the loose areolar tissue in all directions. The mucous membrane of the larynx and trachea is markedly injected, however, whether these parts have been seriously injured or not.

The tongue is ordinarily protruded, and often the teeth have left their marks on the upper and lower surface. Casper,[1] on the other hand,

[1] "Handbook of Forensic Medicine." II., 162.

says: "Repeated observations have convinced me that the condition and position of the tongue are wholly untrustworthy as signs of strangulation. It is found protruded and bitten in many other forms of death, such as drowning, hemorrhage, poisoning, etc." But the majority of authors state that the tongue has a value as confirmatory evidence. Blood may be found issuing from the mouth and nose, and rarely from the ears, but in these cases it denotes extraordinary and unusual violence.

The eyes are usually open and staring; they may be prominent, or even protruding, where the death was particularly violent.

The lungs show evidence of asphyxia; they are engorged with blood, and of a uniform purple or red color; generally there is no evidence of hyperemia, but there are usually patches of emphysema, due to the rupture of air-cells, which are sometimes isolated, sometimes united in groups.

The heart is sometimes quite empty, at other times it is engorged on its right side; ecchymosis and extravasation under the pericardium are not uncommon. The blood is generally dark and fluid, though occasionally somewhat clotted.

The appearance of the brain is more or less variable, and of no particular value in a postmortem diagnosis. It may be congested, though usually it is normal.

There are several interesting cases in medical literature of homicidal strangulation that were not detected until long after death.

The following case is reported by Wharton and Stillé[1]: "After a lapse of thirty-eight days following the interment, a corpse was disinterred by order of the authorities. It was already greatly decomposed, but evidence of strangulation was obtained chiefly from the fact of the striking contrast of the integuments of the neck with those of the rest of the body. There was a white and shrivelled space over the larynx half an inch broad and extending back on each side, from which, also, to the nape of the neck, over the second vertebra, there ran a groove of a blackish-brown color, dry and difficult to cut."

Taylor[2] reports a case in which strangulation was proved after partial destruction of the body: "Fire broke out in a cottage in which at the time were a man, his wife, his stepson, ten years old, and a baby. The man got away with the child and said that his wife and stepson had left the house before the fire. This was false, for the bodies were discovered much charred. They were buried, but later suspicions of murder and incendiarism arose, and they were exhumed. The wife's body was too much burned to serve any end, but around the neck of the

[1] Draper. *Loc. cit.* [2] *Ibid.*

boy there was a horizontal depression a quarter of an inch wide, smooth and quite distinct from the broken, blistered, carbonized skin at either side, and an eighth of an inch deep. The skull was fractured and the tongue protruded, showing strangulation of a living person. The man was found guilty of murder."

Beck[1] relates another case as follows: "The woman disappeared in 1821. Three persons were suspected of murder, but were set at liberty for lack of evidence. After eleven years a body was found buried in a garden. When uncovered it was hardly more than a skeleton. The grave was four feet deep and the body had been tumbled in, resting on its side, with the spine much bent, and the arm raised—a position suggesting that the body had been thrown in head foremost. Careful note was made of the proportions and character of the various parts of the skeleton for purposes of identification. The state of the neck was the one thing of most interest. The third, fourth, fifth, and sixth cervical vertebræ and the right clavicle were held together by a blackish mass, in the composition of which it was impossible to recognize any tissue. This mass was surrounded at its lower part by several twists of a cord two lines in diameter and in a very decayed condition. No knot could be found in it. Its direction was exactly horizontal. The commission (Orfila and others) reported: 'We feel ourselves justified in concluding: 1. That these bones are those of a human skeleton. 2. That the skeleton is that of a female. 3. That this female had attained the age of from sixty to seventy. 4. That her stature had been about five feet. 5. That the hair, which had been of a bright blond color in youth was mixed with gray at the time of death. 6. That the hands had been small. 7. That during life the bones had never suffered any injury. 8. That the woman had died of strangulation, and the act had been, to all appearances, homicidal.' The accused were condemned and sentenced to hard labor for life."

Summary.—The postmortem appearances that supply trustworthy data to prove death by strangulation are, therefore: *externally*, a swollen, livid face; protrusion of the tip of the tongue; ecchymoses in the skin of the chest; local lesion about the neck; injection of the conjunctivæ, and frothy mucus about the mouth. *Internally*, emphysema of the lungs with patches more or less hemorrhagic; deeply reddened mucosa of the trachea and bronchi; froth in the air-passages, which may be bloody, and especially subcutaneous traumatic injury about the neck.

The question as to whether strangulation was produced before or after death may occasionally be an important one. The idea which would cause one to place a string or cord about the neck of a dead person would be to suggest death by suicide, so that an assailant might not be sus-

[1] *Loc. cit.*

pected. The infrequency with which this method of terminating life is used by suicides is enough to cause a presumption in favor of homicides. Moreover, marks of violence will generally be found upon the body or evidence of other injury, poison, or some other agent which will reveal the true cause of death where it has been attempted to divert the suspicion of homicide to suicide. Strangulation is occasionally, though rarely, accidental.

One case is reported where a girl was carrying fish in a basket on her back supported by a leather strap passing around in front of her neck above her shoulders. She was found dead sitting on a stone wall. The basket had slipped off probably while she was resting and this raised the strap up, firmly compressing the trachea.

Taylor reports a case of a boy wearing a silk necktie, who was caught in the band of an engine shaft and had his neck drawn down against the revolving shaft. The circumference of the neck was reduced from 12 to 8 inches; no air entered the lungs for a minute; he was black in the face and blood escaped from the mouth and ears. He was rendered insensible, but fully recovered later.

As a rule, accidental strangulation offers no difficulty to the medical examiner, provided that he takes note of the surroundings and that these have not been disturbed.

Suicidal strangulation occurs but rarely. Its possibility has been denied by many authors. When attempted manually they claim that sufficient pressure cannot be exerted long enough to cause asphyxia. As the presumption is in favor of homicidal strangulation, great caution should be exercised and the evidence should be unmistakable when attributing death to suicide. Several cases are on record of suicidal strangulation. One, a woman forty years of age, who suffered from melancholia, had previously made several attempts to kill herself. She was found dead crouched in her bed and with both hands compressing her throat. The elbows were supported on the knees; the back leaned against the wall behind; the markings of her finger-nails were visible on both sides of the neck.

Taylor[1] reports the case of General Pichegru: "He was confined in prison by Napoleon's orders. At 10 P.M. his cell was locked and the keeper took away the key. He was then alive and well. He was heard coughing in the night. At 7 A.M. he was found dead in bed. A black silk cravat was around his neck, strongly knotted, and a small stick, eighteen inches long and three and a half in circumference, had been used as a tourniquet to tighten the band. One end of the stick lay against the left cheek, where it had caused an excoriation. There were no evidences of a struggle or resistance."

[1] Draper. *Loc. cit.*

In these cases of suicidal strangulation there are certain characteristics which might be mentioned. Some articles of dress, such as a necktie, garter, or stocking, is the most common material for a ligature. The knot is usually in front or perhaps on the side. There may or may not be excoriations, but there are fewer evidences of violence than in homicidal strangulation. The peculiar form of knot may suggest the trade of the victim. Complicated knots are more common than in homicidal cases.

Homicidal Strangulation.—There are certain characteristics in homicidal strangulation which may enable us to form a correct conclusion. In the case of an adult the effects of the violence that has been inflicted is generally evident upon the neck and elsewhere. It is in these cases that we find the most serious lesions about the neck, such as fracture of the hyoid bone or extensive extravasation of blood, etc., which are incompatible with any other view than homicide. The marks upon the neck are generally broader, deeper, and more ecchymosed than those met with in suicidal strangulation, but the absence of violence is not to be taken as proof that it was not homicidal. The victim may have been asleep or made insensible by a blow; or it may be a woman or a child who offered so little resistance that no tell-tale marks were left. Even in these cases where murder is committed generally the assailant inadvertently oversteps the mark and uses more force than is necessary to accomplish his purpose.

An interesting case was reported in the *Lancet*[1] by Dr. Stevenson: "The victim was a medical man, forty-two years old, of good physique and well nourished. On October 11th he was alive and well and with his friends at home. That night he spent in carousing, and early the next morning he was seen with a woman with whom he visited various liquor saloons. About noon she left him in the company of three or four men and at that time he was pretty drunk. He left the beer house with the men, two of whom were supporting him by the arms. The party was noisy, and they walked up the street singing, until they came to a dark and narrow passage leading to a public house. Here one of the men kept a lookout, while one of the others proceeded to rob and, as it turned out, to strangle the doctor. Within five minutes after entering the passage the three men were seen to emerge by the doors of the public house to which it led, and their victim was found on the pavement of the alley insensible and doubled up. His collar and sailor tie were very tight and he was thought to be in a fit. Froth was issuing from his mouth and nose. His neck clothing was loosened, and he was taken to Guy's Hospital, where he was declared to be dead."

Suffocation.—The term suffocation is reserved to signify interference

[1] *Lancet*, February 25, 1893.

with the respiration where it has not been caused by immersion, as in drowning or by compression, as in strangulation or suspension. In other words, suffocation occurs where impure air is breathed; where there is interference with the respiratory tract, either within or without; where the movements of the lungs are limited by pressure on the chest wall, within or without, or where there is interference with the nerves controlling the respiratory muscles. A person is suffocated then whenever any obstruction or other means interferes with or prevents the entrance of air to the lungs in sufficient quantity for the proper physiological function of the blood. Suffocation may be caused in the course of disease, such as tonsilitis, diphtheria, and occasionally bronchitis in young babies; also in cases of hemorrhage obstructing the air-passages, the rupture of an aortic aneurysm into the trachea or bronchi, but these are of little importance medico-legally.

Accidental suffocation may occur from a variety of causes, for example, great pressure upon the chest may be caused by panic in crowds. Such accidents are not at all infrequent in medical literature. They may also be caused by one being buried by the caving in of a bank, or in a well which is being excavated. Death here is due simply to compression of all parts of the body below the neck. It may also include such fatal injuries as result from compression of the thorax under the wheels of a wagon, or a heavy weight falling upon the body. The inhalation of soot or smoke may also bring about fatal suffocation, especially in burning buildings. Here the carbonic oxid is also important. People are occasionally choked to death from the impaction of a piece of meat in the pharynx or other foreign bodies, such as crusts of bread, coins, marbles, buttons, false teeth, etc. Persons intoxicated may occasionally suffocate from the inhalation of vomitus. Occasionally during anesthesia the tongue of the patient falls back and fills the entrance to the larynx and may produce fatal asphyxia.

Infants have been accidentally suffocated by being put to bed under clothing, and by being put face downward upon the pillow, etc.

Suffocation with suicidal intent is not a frequent occurrence. Insanity here generally is a predisposing condition, and women are more apt to be the victims than men. Usually in these cases the mouth is filled with some foreign body, such as the handkerchief or other article of dress, rags or paper. A cork reenforced with sharp pins was used in one case.

Homicidal suffocation can usually be differentiated from accidental or suicidal by the circumstances attending each case, including the situation, surroundings, and condition of the body. The victims are usually the old and infirm, the sick and feeble, and infants. Simple obstruction by covering the mouth and closing the nostrils is enough.

Plaster has been used to reenforce the hand. A wet cloth may be employed. Plugging the mouth with foreign bodies is another method.

The SYMPTOMS produced by suffocation are those of asphyxia: first, there is dyspnea, respirations are ineffectual though forcible; the pulse becomes rapid and irregular; the pupils are dilated, and light flashes before the eyes; there is tinnitus in the ears, and a feeling of fullness in the head; the senses, however, are alert, the mind clear and the memory acute. Later, unconsciousness supervenes; the dyspnea is less marked; irregular spasmodic movements occur, generally accompanied by involuntary micturition and defecation; the heart-beats become irregular, slow and feeble.

Life is usually destroyed in from four to five minutes after complete suspension of respiration; and after five minutes, resuscitation is impossible, although generally possible up to the fourth or even the fifth minute.

TREATMENT.—The removal of the obstruction to respiration is, of course, imperative, and must be done immediately. After this, artificial respiration may be employed. Hypodermic injections of brandy and ether may be given as cardiac stimulants. Alcohol and hot drinks may also be given as soon as the patient can swallow. In this form of asphyxia resuscitation is much easier than in hanging, drowning or strangulation; for in hanging and strangulation we have severe injury to the muscles and other tissues and in drowning the lungs are more or less filled with water.

POSTMORTEM APPEARANCES.—These are more marked, the more rapid and complete the asphyxia and the greater the resistance and struggling of the victim. The external appearances which are characteristic are the lividity of the face, lips and finger-nails; the prominence of the eyes, the protrusion of the tongue, and the dark, bloody froth at the mouth and nostrils; minute ecchymoses of the neck and chest are not uncommon. Occasionally, however, the only signs externally are the blueness of the lips and of the mucous membrane of the mouth.

The internal appearance which is most constant and valuable is the condition of the blood, which is of a dark color and does not clot readily. All of the organs are congested, the lungs especially so; the right side of the heart is engorged with blood, while the left is empty, although there are many exceptions to this rule. There may be many small circumscribed ecchymoses between the pleura and pericardium, but these are more significant of asphyxia in general than of suffocation. These ecchymoses have caused a great deal of controversy in legal medicine, and it is not our province to enter into the merits of the question here. There may be engorgement of the meninges and brain. If

the lungs are hyperemic, the brain is also, as a rule, though often the lungs have a normal aspect. The abdominal viscera present nothing characteristic in this form of death, although there is more or less engorgement of the solid viscera with venous blood.

In asphyxia from hanging or from strangulation there is other evidence to assist the medical examiner in making a diagnosis, but in suffocation, especially where it has been produced without marked violence, even though homicidal, such as by the immersion of the face in the pillow, there may not be any evidence or indication of the fact; so that the medical examiner is often at a loss whether to ascribe the death to natural or violent cause, and must investigate in the most careful and searching manner. Careful examination should be made for the accidental obstruction of the air-passages by a foreign body, such as a piece of meat or vomitus.

In cases of suffocation by pressure upon the chest or abdomen the external lesions are not always found as expected, as the pressure was so widely distributed. But in these cases the skin covering the portion where pressure was exerted, such as the back, neck, or chest, will have a deep discoloration, with many small ecchymoses under the skin.

Internally, the appearances are more pronounced and decisive.

Another class of cases are those where suffocation was caused by burial in sand, meal, dust, etc. These are, as a rule, accidental, although a few cases of infanticide, and rarely a case of homicidal death have been reported. In these cases the offending material will be found within the air-passages, trachea and bronchi, and in the esophagus, and sometimes in the stomach. The claim that the material was placed there after death cannot be supported, especially when found in the stomach and esophagus. In such cases it must have been breathed in during life.

Suffocation may be caused by placing a person in a confined air-space, such as mines, prisons, boxes, trunks, etc. In such cases suffocation is the result of a deficiency of respirable air. To a certain extent, the presence of noxious gases, such as carbonic oxid and carbon dioxid in large amount, may play a part; but, generally speaking, such cases are considered as due to suffocation rather than poisoning.

Drowning.—Death from drowning is one of the forms of death by asphyxia. It is sufficient if only the nose and mouth are below the level of the fluid in which a person may be said to have drowned. Generally understood, it has reference to submersion of the body, particularly the head, in water; but other fluids, such as mud, contents of cess-pools, etc., are equally efficient. Occasionally, a victim is found who is drowned in a very little water. Draper reports a case of a man found drowned in three inches of water in an open cellar, having fallen in while drunk, face

downward, too intoxicated to rescue himself. Occasionally one is found drowned in his own blood, where there has been extensive hemorrhage issuing through the nose and mouth. Sometimes people are found in the water who have not met their death by drowning, but by the finding of a dead body in water death is presumed to have been caused by drowning.

One may suffer an apoplectic shock and fall from a support into the water, but in these cases death is due to natural causes, and not to drowning. Or one may be precipitately thrown into the water, and the nervous shock resulting therefrom may be sufficient to suspend respiration and the heart's action, and in these cases the victim dies from shock, and not from drowning. Further, one may be the victim of homicide and the body put into the water to divert suspicion to death by drowning. There is also the type of apparent drowning where one, suddenly submerged, experiences some nervous shock whereby the respiratory action is inhibited, and the victim does not attempt to breathe at all. In these cases resuscitation is often possible after a longer period of submersion than in the ordinary cases where one attempts to breathe when under water.

The length of time that a person may remain under water depends, to a large extent, upon the habits of the individual. By practice one can remain submerged for a minute to a minute and a half as is seen in expert swimmers, and in those whose vocation takes them into the water, such as deep-sea divers. If the submersion is not to a great depth it may be continued for a much longer period, and cases are reported where, for exhibition purposes, one has remained under water for nearly five minutes. We may say, however, that if a person has been completely submerged for two minutes, the chances of resuscitation are very slight, although there is a case on record, where a person has been submerged for fifteen minutes and another for twenty minutes, who have recovered. Where people have come to the surface from time to time after submersion they will, of course, survive longer, as they have been allowed to breathe more or less.

Where the victim succumbs to shock accompanied by inhibition of the nerve centers, death comes, strictly speaking, from the shock rather than from drowning.

The usual type could be divided into three stages, according to Hofmann: At first the person involuntarily holds his breath, a period which lasts about one minute. In the second stage, the symptoms of dyspnea supervene; the victim can no longer hold his breath, and attempts a few short inspirations, each of which is followed by forcible expiration as the water is reaching to the larynx; a person remains conscious during this stage. Later unconsciousness sets in, followed by

convulsions, and there is loss of reflex action. With the loss of reflex action the water is inhaled deeply into the lungs, penetrating even the small bronchi and alveoli. During the first and second stages only very little water enters the air-passages, and most of this is swallowed; but in the third stage water enters freely into the respiratory tract. Popularly it is supposed that a person may sink three times before succumbing to death. This is not absolutely true, although it may be the rule. There are many factors entering into this second stage, such as the buoyancy of the body, for a fat person will float more easily than a person without much adipose tissue. Women are often assisted by their skirts from sinking rapidly. Children and infants will float more readily, as their skeletons are lighter and their fat more abundant.

Drowning is popularly considered a not unpleasant form of death. The reports of those who have been resuscitated generally bear this out.

Admiral Beaufort fell overboard in Portsmouth Harbor and sank before relief reached him. He was rescued within two minutes, and the experiences that happened in that short interval were related by him as follows:

"From the moment that all exertion had ceased, a calm feeling of the most perfect tranquility superseded the previous tumultuous sensations . . . I no longer thought of being rescued, nor was I in any bodily pain. On the contrary my sensations were now pleasurable, partaking of that dull, but contented feeling which precedes sleep. Though the senses were thus deadened, not so the mind; its activity seemed to be invigorated in a ratio which defies all description, for thought rose after thought with an indescribable rapidity. These thoughts took successive courses: My fall overboard, the awkwardness which had caused it; the bustle it must have occasioned; the effect it would have on a most affectionate father, and a thousand other circumstances minutely associated with home, these were the first series. They then took a wider range: Our last cruise, a former voyage and shipwreck; my school; the progress I had made there, and the time I had misspent; my boyish pursuits and adventures. Thus travelling backward, every past incident of my life seemed to glance across my recollection in retrograde succession. Not, however, as here stated, but the picture filled up with every minute collateral feature . . . Indeed, many trifling events which had long been forgotten then crowded in with the character of recent familiarity."

Postmortem Appearances from Drowning.—*External Appearances.*—The color of the skin is pale; lividity may be slight, but is generally absent, and this is seen only shortly after death; in the course of a few hours and before decomposition sets in, the face takes on a uniform bright, reddish color. This peculiar change in the color of the face, the rest of the body remaining pale, is almost characteristic. The skin is

not swollen as in beginning putrefaction. Later there appears a distention of the tissues of the neck and face, the rest of the body remaining unchanged. The face becomes permanently swollen, the tongue protrudes, the lips puff out, and the eye-lids are distended, rendering identification almost impossible. "Cutis anserima" is a condition of the skin that is often met with in drowning, and is best seen on the anterior surface of the extremities. It is not particularly diagnostic, but is to be included in the other appearances. The palms of the hands and soles of the feet are blanched and wrinkled, and later, the elbows and knees assume this appearence, but this is not found only in death by drowning. Rigor mortis sets in early and is marked.

The position of the drowned body in the water is sometimes striking. Observed from above the person appears to be sometimes swimming or leaping, but of more value than this is the appearance of froth at the mouth and nostrils. It appears soon after recovery of the body and only in fresh bodies. It disappears rapidly in summer weather, and even in a few days in winter. Pressure on the thorax may cause a new discharge if the first has been washed away. It is generally white, although it may be pinkish from the presence of a small amount of blood. This froth may be similar to that occasionally seen in death by hanging, but in these cases generally the amount of froth is small, and it is composed of mucus mixed with air, and closely adherent to the tissues, while the water froth of the drowned person is abundant and foamy, and consists of minute bubbles.

Injury to the hand or other portions of the body may be observed, and there may be mud, grass, or other material grasped within the hand, or around and under the finger-nails.

Internal Examination.—The internal appearances are not especially characteristic; the blood, however, is even more fluid than in most cases of suffocation, and the liver shows marked anemia. The condition of the lungs is the most important; on opening the chest, the lungs are seen to be bloated and not collapsed as usual; the surface of the lung may show a diffuse bluish mottling, and there may be found small areas of emphysema between the air-vesicles; the color of the lungs is generally red or purple; subpleural ecchymoses are commonly situated between the lobes and at the base, varying in size and in number, being due to the rupture of the capillaries; on section, the lung appears red on account of the hyperemia, and a watery, bloody fluid exudes. This is regarded as of great value among the signs of drowning; it shows that the fluid in which the victim was submerged had been drawn into the bronchioles and alveoli, but this may be brought about artificially by the submersion of a dead body in the water, but only after a long time; so that this sign is of more value when the autopsy is performed soon after death.

The appearance and condition of the trachea and bronchi are of great importance. The mucous membrane is hyperemic and the contents of the trachea and bronchi are like lather; it is finer than in death by suffocation and is more or less transitory. One author says that it disappears in from 5 to 5½ hours in summer, and on the fourth day in winter. It appears sooner in winter than in summer. It is found more abundant in the smaller bronchi, although it is often found in the larger bronchi and trachea. The question whether this appearance is dependent upon sinking and subsequent rising of the body to the surface and again sinking has been raised by many, but the English Medico-Chirurgical Society conclude from experiments on animals that "the presence of froth in the air-passages does not depend on the fact that a person rises to the surface after submersion, although this may increase the quantity."

In any case it is evidence of life during the drowning. It cannot be produced by artificial means, and is proof that violent efforts to breathe were made on the part of the victim.

Bergeron and Mentano say emphatically: "The presence of a frothy foam in the pharynx, larynx, and bronchi is a constant sign of death by submersion . . . whether the individual was free in his movements, or was thrown into the water narcotized, or partially suffocated, or after being fettered in his action."

Foreign bodies other than foam are often found in the air-passages. Whatever was suspended in the water may be found, such as mud, leaves, grass, sea-weed, sand, etc. Where the victim was drowned in other media, such as the contents of vaults, or in liquor amnii, meconium, or blood, the material is easily recognizable by the microscope.

The heart shows the appearance that would be expected in death by asphyxia—the right side is distended with blood, while the left is nearly empty. The blood of the heart is usually fluid and of a dark color. The abdominal organs are not particularly characteristic. There is hyperemia of the peritoneum and vessels of the mesentery, and of the solid viscera.

The presence of water in the stomach is more or less constant, but often is found mixed with other contents so that it is not of great value. Occasionally we find mud, sea-weed, and other material in the stomach from its presence in the water that has been swallowed. Water may be found in the stomach postmortem; that is, it may have reached that organ after death by drowning. Hofmann has proved that fluids may penetrate into the stomach after death.

The brain shows nothing particularly characteristic, though the blood-vessels are generally injected, but this may have been caused by

other conditions, such as alcohol, mental excitement, or violent struggling before immersion.

When a body is recovered from the water the question naturally arises whether death was by drowning or was death previous to submersion of the body. For a decision on this point we must depend largely upon the evidence that is available in addition to the post-mortem appearances. A person may suffer an apoplectic stroke and fall into the water. Here the absence of lesions on the outside of the skull over the seat of injury would enable one to rule out death by violence. On the other hand, a person in diving may strike a rock or some other obstacle which has inflicted wounds that may simulate marks of violence. A body may be thrown against a rock or an abutment, or floating logs, or be torn by hooks, and show other injuries suggestive of homicide. Soft tissue may be lost from the attacks of fishes and water rats, so that it becomes much more difficult to answer whether these lesions were inflicted before death in cases where bodies have been in the water for a considerable time.

Determination of the Interval Between Death and the Recovery of the Body.—The length of time that a body has lain in the water cannot be accurately determined after putrefaction has once begun. The rapidity and nature of the changes that the body undergoes vary more or less with the sex and age of the victim, the temperature of the water and air, the depth and nature of the water (whether fresh or salt, still or running), the attacks of fishes or other animals, and finally, whether the body is covered or not.

Devergie gives the following result of his experiments on a body left in the water all one winter:[1]

Three to Five Days.—Cooling and freezing of the body; the skin becomes pale.

Four to Eight Days.—Joints supple; skin natural color; palms of hands pale.

Eight to Twelve Days.—Flaccidity of all parts, back of hands pale, face blanched and of a different color from the rest of the body.

Two Weeks.—Face slightly puffed, red in places; greenish tinge over sternum; epidermis of hands and feet white and beginning to pucker.

One Month.—Face reddish-brown; eye-lids and lips green; reddish-brown patch surrounded by green on the anterior surface of the stomach; skin of palms and soles white, thick, folded.

Two Months.—Face brown, swollen; hair loose; epidermis of hands and feet in large part detached; nails still adherent.

Two and one-half Months.—Epidermis and nails of hands detached, red discoloration of the subcutaneous tissues of the neck and parts around the trachea and thorax, partial saponification of cheeks and chin, and superficially of nipples, groins and anterior parts of the thighs.

[1] Draper. *Loc. cit.*

Three and one-half Months.—Destruction of part of the hairy scalp, eye-lids and nose, partially of the face, upper part of the neck, and thighs, destruction of the skin on various parts of the body, epidermis and nails of the hands and feet completely gone.

Four and one-half Months.—Almost complete saponification of the fatty parts of the face, neck, groins, anterior parts of the thighs, calcareous deposits on the thighs, beginning saponification of the anterior part of the brain, calvarium denuded and beginning to be very brittle; opaque condition of most of the hairy skin, associated with its destruction.

In warm weather the changes would undoubtedly be more rapid. Devergie's statement of the changes described above as taking place in the first month would take place in the first five to eight hours. Those of the second month, the first day; those of the third month, the second day, and those of the fourth month on the fourth day.

On the other hand, Draper says that his own observations on the bodies of the drowned do not correspond with those above, and as an illustration he mentions the case of a sailor who was drowned on October 20 and the body "recovered November 3, or fourteen days later. The scalp had entirely disappeared, leaving the skull bare; much of the soft tissue of the hands was also gone."

Maceration takes place probably more rapidly in salt water than in fresh. This may, however, be due to the attacks of fishes and other animals, for bodies recovered from the ocean show that putrefaction takes place comparatively slowly.

The length of time that a body will remain submerged before rising to the surface is of considerable variation. It depends upon the rapidity of decomposition, and, therefore, the time is much less in summer than in winter. It also depends upon the density of the water, that is, whether it is fresh or salt, and to a certain extent upon the nature of the body itself, whether it is fat or lean; if the former it will rise sooner than if the latter. The quantity of air and gas in the lungs and intestines also has an influence on the time of the floating. On the other hand, the body may be held down by weights, so that it will not rise at all, or by twigs, roots, sea-weed, etc., which may keep it from rising until it is dislodged. According to Hofmann, in summer the body usually comes to the surface on the second or third day, rarely after two or three hours.

Putrefaction goes on more slowly than in cases where bodies are exposed to the air, but when the body has once been removed from the water, putrefaction is much more rapid. This is especially noticeable in the head and neck.

The question whether death by drowning was suicidal, homicidal, or accidental is one of circumstantial evidence rather than medical evidence. Suicidal drowning is far more common than homicidal, and the sug-

gestion of suicide is often borne out by the finding of weights in the pockets of the victim's clothing or tied to his feet or neck. Homicidal drowning is often the means of infanticide. Evidence of struggling on the shores or other support in the neighborhood of the region where the body is recovered from the water is suggestive of homicidal drowning. Where the hands are found tied the question must be decided between suicidal and homicidal, bearing in mind that suicides often try to divert suspicion from their own intentions.

CHAPTER IX.

DEATH FROM COLD, HEAT, ELECTRICITY, AND STARVATION

Cold.—The continued exposure of the human body to a low temperature may often cause death. The degree of cold necessary to produce death depends largely upon other conditions, such as the nutrition, general health, and resisting power of the individual. Severe cold is much more fatal to the very old and the very young than it is to those in middle life, also to those who are feeble, ill-nourished, or who have endured chronic wasting disease. Many deaths have occurred among infants on account of this cause. On the other hand, people have endured exposure to 20° or 30° below zero, and when properly clad and nourished have withstood it without any harmful results. As is well known, those who indulge in alcoholic stimulants are more apt to be subject to cold. Alcohol acts as a deleterious agent, preventing the normal metabolism of the body when taken in large doses, and thus the vitality and resisting power to the effects of cold are lowered.

The SYMPTOMS produced are, first, a constriction of the blood-vessels which cause a paleness, and later, a peculiar lividity of the countenance. The pulse is hard and rapid, becoming feebler after exposure. The respirations are diminished; there is a sense of fullness or a heavy feeling in the head; more or less anesthesia, accompanied by an unsteady gait and confused speech. The blood-pressure is lowered, and, according to some authors, there is specific action upon the red corpuscles of the blood. These symptoms increase; perception and sensation are diminished, followed by paralysis of the limbs, drowsiness, and exhaustion. These symptoms are, in a measure, due to the action of the cold upon the blood. The hemoglobin which is the normal oxygen carrier to the tissues is prevented from exercising its normal function, and, on account of this lowered metabolism, the symptoms above are noticed.

Recovery after exposure to intense cold or even after long exposure to moderately low temperatures often takes place. Animals that have been experimented upon by dousing them with ice-water for a considerable length of time have, under proper treatment, entirely recovered.

Postmortem we find on external examination rigor mortis in marked degree. By this is meant not the stiffening due to freezing which makes the body appear like a marble statue, but this true rigor mortis is noticed after the body is thawed out. There are numerous postmortem discolorations of a bright red color in those parts of the body exposed to the air. This is explained on the assumption that the hemoglobin of the blood loses its power of giving up oxygen, and that there is more oxyhemoglobin present than there is ordinarily present in most cases of death from other causes. The body of a person who has died after exposure to cold is particularly susceptible to the process of decomposition after thawing, especially in the presence of warmth and moisture, and it should be borne in mind that the freezing itself is a preventive of decomposition, so that finding a body frozen, but somewhat decomposed, presupposes that the freezing was subsequent to death. On section of the body the blood is found to be brighter than usual on account of its large content of oxyhemoglobin, as above mentioned. Most of the organs are congested and many of the cavities are found engorged with blood; this is especially true of the heart and of the brain and its membranes, also its blood-vessels. So that it is seen that the postmortem appearances are not particularly characteristic, but with other facts taken into consideration, such as the season of the year, the place where the body was found, the duration and other circumstances of exposure, we will, in the absence of facts pointing to other causes, be enabled to make a diagnosis of death by exposure to cold.

Heat.—Heat has not been used as a means of homicide in the history of legal medicine, but on the other hand, certain occupations have led to the exposure of the body to heat, and which have been attended by fatal results. The exposure of the body to intense heat may be followed by one of two conditions. Occasionally the victim is found in a state of profound exhaustion, which may have appeared suddenly or slowly; the pulse is rapid and feeble, the temperature subnormal; the mind is usually clear, although unconsciousness may occur; muscular relaxation is marked and muscular strength vanishes. The exhaustion is extreme, and syncope may follow. The other condition, which is by far the more common, embraces the condition caused by sunstroke.

The popular idea that to suffer sunstroke one must be exposed to the direct rays of the sun is not true. Many of those who have suffered from the effects of intense heat may suffer when they are completely shielded from the direct sun's rays; so that thermic fever or heat-stroke are perhaps better terms.

As has been described under Cold, there are many conditions affecting the influence of heat upon the human body. If the victim has been engaged in muscular exercise, the chances of heat-stroke are increased

and the chances of recovery are lessened. People addicted to the use of alcohol in excess are also more subject to heat-stroke. Men are far more susceptible to heat-stroke than women on account of their exposure, and the laboring classes are more commonly attacked than those in the better walks of life. The temperature which is fatal to human life on short exposure cannot be stated definitely. Cases of heat-stroke are due to conditions other than exposure to heat. Whether it is the long exposure in mid-summer from the occurrence of several very hot days with the lessened vitality that may supervene or not, is a question which has not been satisfactorily answered.

There are cases on record where people have endured excessive heat, that is, above that of boiling water, for several minutes without experiencing any harmful results. In these cases the respiration was affected but slightly and the pulse not much accelerated. Undoubtedly in these cases the excessive temperature was endured with impunity on account of the dry condition of the air. Dry heat is much more easily borne by the human system than moist heat, and it is under the latter condition that many cases of heat-stroke occur, whereby the normal function of the skin as an eliminating organ is interfered with.

Symptoms.—The symptoms of heat-stroke are a sense of weakness, disinclination to exert one's self, vertigo, and headache; the ideas are confused; often there is a sense of oppression about the heart and epigastrium, and there may be abnormal color sight, everything looking blue, red, or green. In those cases which end fatally, insensibility is generally present. The breathing varies: sometimes it is rapid, sometimes deep and labored, often stertorous; the pupils are sometimes dilated, although later in the attack they may be contracted. The skin is generally hot and dry, with a temperature ranging above 105° F.; the pulse is rapid, becoming irregular and intermittent. Although coma is present, there is often much restlessness, and there is intense nervous disturbance.

The postmortem appearances agree with the symptoms noticed during life. The increased heat persists for some hours after death. Rigor mortis occurs early and soon disappears. Putrefaction sets in more rapidly than ordinarily. The left ventricle of the heart is contracted, while the right side is distended; the blood is dark and fluid and does not tend to coagulate.

Electricity.—The most frequent source of danger from electricity is in machinery used for generating and distributing this product. As a rule, accidents occur from the distributing portion of the system, rarely from personal contact with the generator or dynamos. This distributing system not only includes the proper lines or wires, conduits pertaining to a given plant, but also to those wires which may accidentally have

come in contact with a "live wire", and thus become charged and a menace to the community.

The effects caused by the different kinds of current need only be mentioned briefly. This has no reference to the many kinds of galvanic and static electricity which are used so freely by practitioners for therapeutic purposes and which do not cause fatal injuries. It has particular reference to the more powerful direct and alternating current systems so largely used by street railroads, municipal lighting companies, and for mechanical purposes. With the direct or constant current the "shock", so-called, is caused by the opening and closing of the circuit, and the injury is from this shock. The passing of the electricity through the system after the circuit has once been completed does not cause the shock, although it may cause burning or other effects. With alternating currents the principle is the same, but here we have several shocks given in a very short space of time, from the nature of the current.

The primary effect of a strong current of electricity is to produce a contraction of the muscles, and this contraction persists as long as the current is passing. This is true not only of the muscles in contact with the wire, but nearly all of the voluntary muscles may also be involved. The result is that on account of the muscular contraction one is unable to release his hold if contact has been made by the hands. Further, the muscles of the limbs and of the trunk may be so strongly contracted that the person is thrown violently. The visible effect of an electric shock is generally that of a superficial burn. As a rule, the skin is not a good conductor of electricity; it is a very poor conductor when dry, but when moist, conduction is much easier. In these latter cases the current passes from the wire to the body quite easily, but where the skin is absolutely dry, currents, even moderately strong ones, may be handled with a moderate degree of safety. Where the burn is upon the dry skin, especially upon the palmar surface, which is its most usual situation, there is a deep eschar with clearly defined edges, corresponding to the point of contact, and the deeper parts show blackened and burnt tissue.

In addition to these visible effects of the passage of an electric current, there are also others affecting the nervous system, the chief one of which is the immediate loss of consciousness. This may be followed by condition of collapse, cold extremities, and feeble pulse. The face becomes cyanotic, the pupils dilated, and the respiration stertorous. This condition may last for some time until death supervenes, but on the other hand death may be instantaneous.

The POSTMORTEM APPEARANCES of death by electrical currents are burns showing the points of contact. Rigor mortis comes on very early and disappears almost immediately. The internal organs are not very much congested; the blood is dark and fluid. Microscopic examination

fails to show any abnormal changes in the tissues. The brain and spinal cord show nothing extraordinary, so that the characteristics postmortem are not marked.

Electrocution.—The execution of criminals by the electric current is practiced in New York, Ohio, and Massachusetts. The victim is strapped down in a heavy chair and one electrode adjusted covering the forehead and temples. The other is applied to the leg, burns being prevented by moistening the skin. An alternating current is used and the current applied for ten seconds to a minute; to be sure of the result this is repeated two or more times. The effect on the body is severe muscular contraction; the body becomes rigid and consciousness is immediately lost. The body remains rigid until the current is broken, when all of the muscles collapse and the victim is in a state of complete muscular collapse. If one contact is not sufficient to arrest all evidence of life the current is again applied with the same phenomena. The consensus of opinion is that there is no possibility of resuscitation.

Lightning.—Injuries from lightning are similar to those by large electric generators. Accidents of this nature occur more frequently during the hot season, and generally during heavy rain storms. The effects are either burns, severe nervous disturbances, or death. Loss of hair is a common consequence, and blindness also; paralysis of the limbs is fairly frequent, but these functional disturbances, as a rule, last only a short time, complete recovery eventually taking place. The appearance of the burn is more or less characteristic, often simulating the pictures of trees. Occasionally there are fractures of the skull or of the limbs. The clothing may be ripped off of the body. The freaks that lightning plays, however, are remarkable. In one case the victim may be wholly deprived of his clothing and his body be intact. In another the clothing may show no evidence and the man disappear. A person may be thrown violently to the ground and for some distance, where another may be left rigid, with his muscles fixed in the very position they held at the time of death.

The POSTMORTEM APPEARANCES of the body of one who has been killed by lightning are not characteristic. Unless there are fractures or some other severe injury there may be nothing more than a burn, more or less severe, showing the point of entrance of the lightning stroke. In other respects the appearances are similar to those described under electricity. The burns caused by lightning stroke vary markedly; their situation generally shows the tract of the electricity. The most severe burns are often where metallic substances are worn or carried about in the clothing. It may sometimes happen that the heat is so intense as to fuse coins together, and there may occasionally be a metallic deposit on the skin beneath. The fractures which may be caused are generally

due to the violence with which the victim is thrown to the ground or against other objects, such as trees.

Starvation.—Death from starvation is a rare occurrence, and considered from its criminal relation it is extremely unusual. By far the larger number of the victims of starvation are those who through accident have suffered from prolonged privation; stowaways on board ship, persons lost in the woods, shipwrecked sailors, explorers, etc.

Starvation may also be classed among the forms of violent death as it may be the result of criminal neglect in the treatment of children, infirm or decrepit persons, and in this way constitute homicide. We may divide the subject into two parts, *acute* and *chronic starvation*. By ACUTE STARVATION we mean the sudden and complete withdrawal of all food. The period which a person can go without food depends upon the method of starvation. Naturally, the adult in good health will live longer than an infant or an infirm person. As a rule, we may say that acute starvation causes death in about ten days. There are numerous cases on record where persons have survived longer than this, but most of them were probably aided by the ingestion of some fluid, probably water. In medical literature there are numerous cases of prolonged abstinence from food, which are very remarkable, but most of them are unattested and probably not worthy of credence.

The *symptoms* of acute starvation are, first, a sense of hunger, although it is generally thought that hunger usually persists as long as consciousness lasts; as a matter of fact, it is only temporary and rarely lasts longer than forty-eight hours. Coincident with this feeling of hunger is a feeling of pain in the stomach, which can be relieved by pressure. Although the sense of hunger lasts but a short time, thirst persists and is often intolerable. This is easily explained when we bear in mind how necessary water is to the tissues and for the functionating of all organized structures. Soon after starvation begins the body shows evidence of emaciation; the loss of tissue falls chiefly upon the fat, blood, pancreas, spleen, liver, intestines, and muscles; to a less extent upon the skin, kidneys, and respiratory organs, and least of all upon the nervous tissue. The features are pinched; the eyes sunken and staring, and the malar bones become prominent. The abdominal wall becomes concave, and the vertebral bodies are easily felt. Extreme muscular weakness supervenes and it may progress so far as to simulate paralysis, and the victim be unable to move. The whole body exhales a fetid odor, later becoming almost putrid. The mouth is dry, the mucous membrane of the outlets frequently red and inflamed. The urine, if there is any, is highly concentrated, high-colored, and turbid. The pulse is slow, but later becomes more rapid; the bodily temperature is not markedly changed at first, but later it is lowered, and just before death the patient com-

plains of feeling cold. In addition to these physical signs, we meet with mental and nervous disturbances which are more or less characteristic. Occasionally the mind remains clear, but more often it becomes weakened and enfeebled.

In regard to the length of time necessary to produce fatal results in acute starvation there is much diversity of opinion. If a person is kept warm he will live longer in acute starvation than if exposed to cold. An allowance of water, all solid food being prohibited, will enable one to live much beyond the limits which have been stated above. Miners imprisoned in damp mines have obtained much relief from the damp walls and air. The mental state of the person starving, whether sane or insane, seems to have an influence on the power of endurance; the insane survive, as a rule, much longer.

Postmortem, the most pronounced feature is the wasting of the tissues which external examination reveals, but this emaciation is not so marked in acute starvation as it is in chronic starvation. The skin is shrivelled and wrinkled, sometimes has a dirty brown coating, and a rough scurvy surface; the subcutaneous fat is lacking and the body appears more or less mummified. Putrefaction generally sets in early and progresses rapidly. Occasionally atrophy of the heart is present, but, as a rule, this is not common. The lungs are somewhat anemic and decreased in size; otherwise normal. The blood is less in amount than in health and appears thin and fluid. The pancreas is also atrophied, sometimes having totally disappeared. The omentum is destitute of fat; the stomach small and contracted, and its mucosa pale and corrugated; the kidneys apparently do not suffer much; in some cases they have been recorded as pale, in others congested.

Chronic Starvation.—The partial withdrawal of food and liquids, so that the amount administered is inadequate for the daily needs of nutrition, will cause death as the result of inanition. The symptoms are essentially the same as those of acute starvation, although they differ in degree: the temperature becomes subnormal as a result of the disturbance of nutrition; there is emaciation, dry and rough skin, an exceedingly fetid odor from the body; great muscular weakness, and dejections which are dry and dark, and scanty, high-colored urine.

In a famine in the East Indies, inflammation and ulceration of the corneæ, copious lacrimation, and blindness from destruction of the eye-lids were observed. Nervous symptoms are also observed in this form of starvation—delirium, convulsions, and coma.

The *postmortem appearances* do not vary materially from those already described. There is wasting of the tissues, disappearance of the fat, muscular atrophy, a marked decrease in the thickness of the walls of the stomach and intestines, and decreased size of the liver and pancreas.

Most cases of chronic starvation are the result of accident, as mentioned at the beginning. In 1835, in Scotland, a man sixty-five years old, was accidentally locked up in a mine. He had access to some dirty water which he was unable to obtain after the first ten days, on account of his weakness. Twenty-three days after entombment he was found and brought out alive, but he survived only three days. In a case of shipwreck, thirteen men were without food or water for twelve days; three died, the others survived. In another case, eighteen sailors were shipwrecked, without food, seven of whom survived as follows: One, eleven days; one, twelve; one, fourteen; two, fifteen; one, eighteen, and the last, twenty-eight days.

In the memorable expedition of Greely to the Arctic region, chronic starvation was the worst feature. So long as the party had food, the cold was easily endured, but when the food gave out their suffering was intense.

Occasionally suicide has been accomplished by starvation. It seems hardly possible that one's resolve could be maintained in spite of the discomfort and agony of prolonged inanition. Of the many cases of reputed long fasting, there are probably none worth mentioning; most, if not all, have been proved to be "fakes". Homicide by starvation is, fortunately, not a common occurrence. One of the most common phases is infanticide. Occasionally the victim is an adult who is mentally unsound and feeble, or infirm and decrepit, or one over whom another has absolute control.

In these cases of homicidal starvation the term is not to be taken literally. The law requires evidence of insufficient supply, coupled with absolute proof of the fact of malicious and evil purpose, and that the neglect was willful and criminal.

It is commonly maintained that the starvation was the result of an incurable wasting disease, and not due to willful or malicious neglect. Of the diseases causing inanition and consequent starvation, we may mention stricture of the esophagus, malignant disease in any part of the body, tuberculosis, diabetes, chronic diarrhea, and Addison's disease. There are also certain neuroses which have no pathological lesions, but which may be attended with marked emaciation

The Staunton case (Reg. *versus* Staunton, C. C. C., September, 1877) illustrates the difficulties attendant upon the medico-legal investigation of a case of homicidal starvation.

Harriet Staunton, thirty-five years old, of a weak intellect, was kept in close confinement by her husband and a girl with whom her husband was intimate and by Staunton's brother and his wife. When the victim had been reduced to a condition of extreme inanition she was removed to her home in Penge, where she died the following day in a

state of complete exhaustion. A few hours before death she was seen by a physician, but she was then insensible and in a state of complete collapse. The postmortem appearances showed the body to be greatly emaciated; the skin parchment-like, dry and shriveled; the muscles almost entirely free from fat, and the body covered with vermin. She weighed but seventy-four pounds, while two and a half years previously she had weighed about one hundred and twenty pounds. The stomach was contracted, its walls much thinned, and the food within distinctly visible; the intestines were pale, shrunken, and muddy. The only sign of disease was slight tubercular deposit at the apex of the left lung and a congested appearance at the cardiac extremity of the stomach, as well as of the duodenum. There were two small patches of miliary tuberculosis upon the arachnoid membrane on the upper surface of the left hemisphere of the brain; there was no appearance of meningitis. The medical man who examined the body stated that there was no disease in the body sufficient to cause or to account for the extreme emaciation and exhaustion, and, in view of the appearances which included all those which the best authorities regard as due to death by starvation, it was his opinion that the cause of death was starvation and neglect. The defense urged that the emaciation and other symptoms were due to the tubercular meningitis. This was maintained by three medical men who had not seen the body or had not even had an opportunity to consult with those who had made an examination. The general evidence satisfied the jury that there had been intentional and deliberate neglect, and that the prisoners were guilty of willful murder. The popular feeling at that time ran very high, as some thought that the conviction was not warranted. It was urged that the esophagus had not been examined for stricture; that the presence or absence of diabetes had not been proved, and that it was not definitely shown that Addison's disease might not have been present. In view of this the sentence was commuted from capital punishment to life imprisonment for three of the guilty ones, and in the case of the fourth, where the evidence showed only complicity, the prisoner was discharged.

CHAPTER X.

BURNS

Heat brought in contact with the body, whether by solid substances, liquids, or gases, may result by its action in a burn. Certain substances by their chemical properties may also exert a caustic action or burn.

Solid substances produce circumscribed burns, while liquids give a more diffuse area, and gases produce the most extensive and the severest burns. A burn may be severe or slight, depending upon the temperature of the heated body, and upon the length of time that it is in contact with the body. Burns caused by hot liquids are popularly called scalds. Burns may also be caused by friction, the so-called "friction burns."

Classification.—Burns have been classified according to their degree of severity. The first degree is accompanied by reddening of the skin without the formation of blisters. In burns of the second degree, blisters are formed, which contain clear serum, sometimes slightly turbid, and occasionally filled with blood. In the third degree the external surface of the skin is destroyed, and the portion that has been destroyed is seen as an eschar which is soft if made by a liquid, and hard and brown, or even black, if made by a solid or by a flame. This is usually surrounded by burns of the first and second degrees. The fourth degree differs from the third degree only by the greater depth of the slough. In the fifth degree the subcutaneous cellular tissue and portions of the muscles are destroyed. The external appearances may not be different from those seen in burns of the third and fourth degrees. In the sixth degree we have complete carbonizing of the part.

The injurious consequences from burns are due to the extent of the surface involved rather than to the depth of the burn. First-degree burns covering two-thirds of the body are seldom recovered from, and burns of the second or severer degrees involving a third of the body are generally fatal. Children are more susceptible to the effects of burns than adults.

Burns not necessarily fatal in themselves may be followed by fatal

results, due to the infection of the exposed surface. The cause of death after burns is dependent upon many factors. If the victim was confined in a room that was on fire, death may have been due to asphyxia. Shock is a very important element, especially where death soon follows. There may also be congestion of the internal organs, and even nephritis as a result of extensive burns.

Externally, the local lesions of a burn of the first degree may be

FIG. 1.—EXTENSIVE BURNS WITH RECOVERY.
Note the contraction of tissues.

entirely negative. If the burn was of the second degree, there will be seen the characteristic blisters, showing the eschar in the burnt tissue. Where carbonizing of the tissues has occurred in burns of the sixth degree, there may appear cracks which may simulate incised wounds. If this occurs on the abdomen the viscera are seen shriveled and charred.

The postmortem appearances are not characteristic of death by burns. There may be congestion of the internal organs; occasionally edema

of the brain, and duodenal ulcer. If the person survived for a considerable time, there may be fatty degeneration of the internal organs, hypostatic pneumonia or bronchopneumonia, and sepsis may intervene from infection of the burn.

Burning of the body postmortem has often been resorted to in order to cover up evidence of crime. The time taken for the complete destruction of the body depends upon the kind of fire and the size of the

FIG. 2.—SIDE VIEW OF FIG. 1.

body. In crematories complete burning does not take place usually in less than one and a half to two hours, and where cremation is attempted by setting fire to the clothing or to the room in which the body lies the time is considerably longer. In these cases only partial cremation or incineration takes place, the body being found more or less charred, but not completely destroyed. The identity of a charred body is often very difficult on account of the destruction of the body surface, and the shrinking and contraction that may take place. In cases where nothing but

charred remains exist, identification of the sex may be made occasionally by the presence of the uterus, and the age of the victim approximately by the appearance of the hair upon the genitals.

The question as to whether the burns, were sustained before or after death is an interesting one. Burns that are received during life

FIG. 3.—EXTENSIVE BURNS WITH RECOVERY.

will show the characteristics mentioned above. Those received post-mortem may also be divided into several degrees. Slight burns cannot be inflicted upon a dead body because it is impossible to produce the characteristic reddening due to the disturbed circulation, and the red-

ness of burns of the first degree disappears after death. Burns of the second degree for the same reasons cannot be produced upon the dead body under ordinary circumstances. Blebs may be obtained which are filled with a clear, watery liquid, but which do not contain the serum of antemortem burns. Experiments performed upon dead bodies show that this is the usual condition: namely, that the blebs obtained postmortem contain nothing but water, whereas those antemortem are filled with serum which may occasionally be coagulated. But what is still more characteristic is, that in postmortem burns of the second degree the congestion and inflammation of the skin around the blister, marked by a red line cannot be produced. This is characteristic of antemortem burns of this description. And the same may be said of the appearance of the true skin beneath the blister. There are in opposition to these well-established and generally accepted views some authors who maintain that true blisters can be formed upon the body postmortem immediately after death. In these cases it is perhaps open to doubt whether molecular death has actually set in, or whether the person was not in the last stages of somatic death.

Burns of the third degree cannot be produced postmortem on account of the coagulation of the blood in the capillaries during life. Hofmann attempts to differentiate between burns of the third degree that are postmortem and antemortem by means of the microscope. A piece of the skin is removed, and on inspection the uniform brownish-red color shows it to be composed of an exceedingly fine net-work of capillaries. This condition proves that at the time of the burn the capillaries were full of blood, therefore, that life was present. In burns postmortem a similar examination of the skin shows that the capillaries are empty, and there is no trace of injection in the corium.

Burns of the higher degrees—fourth, fifth, and sixth—are not characteristic, but Hofmann considers that they are probably postmortem if extensive.

In Wharton and Stillé's "Medical Jurisprudence" there is an interesting account of a body that was burned and charred out of all proportion to the destruction of the neighboring objects, and to an extent which seemed incapable of being accounted for by the heat of the burning clothes and objects in the vicinity.

"On the 14th of March, 1869, my father and I were requested to examine the remains of Mrs. Warrack, of Ross, aged sixty-six, who resided alone in a house near the bridge of Dee, Aberden. She was said to have been stout, of intemperate habits, and her son stated that he had left her at 10 A.M. on the 14th in her usual health. She was found at 11 A.M. on the same day, lying burnt on the lower steps of the stair of her house on her left side. The house was pervaded with a

disagreeable smell, but more like that of burning straw than of burning animal matter. The room which she usually inhabited, the door of which was within two yards of the place where she lay, had the same smell; the chair in which she sat stood in the middle of the room, its back almost entirely consumed, and its arms wholly so. The seat of the chair showed mere traces of the actions of fire. The bed, about two feet from her chair, had its straw mattress slightly burned at its fore part. The wood-work of the bed and the curtains were uninjured. Her chair was about four feet from the fireplace, and about two feet from an uninjured mahogany table, on which stood an empty beer bottle, smelling of whiskey. Nothing else in the room was touched by fire. The stairs were of wood, and underneath and in the immediate vicinity of where she lay, they were charred to the depth of a quarter of an inch. The perpendicular bars of the hand-rails similarly charred beside her for a foot up, the top rail and the wall, which was a half a foot from the hand-rail, blackened by smoke.

"The condition of the body, however, showed that the fire had caused the greatest alterations in it. The hair was burnt off, the soft parts of the face and front part of the head burnt off, the bones exposed, blackened and calcined. The back of the head, the neck, and the trunk everywhere converted into greasy charcoal to the depth of about an inch, the skin totally removed, and the bones of the trunk lying bare, blackened, and calcined.

"The front wall of the abdomen totally destroyed and wanting; the intestines burned into a hard and blackened mass; the liver converted into ashes for the depth of an inch, but retaining its shape, its left lobe projecting nine inches from the margins of the ribs.

"The upper limbs distorted; the elbows strongly flexed, and everywhere charred to a great depth, the bones, however, even of the fingers, preserving their position. The right thigh had its deeper muscles still uncharred, but of the appearance of roasted beef, and very dry; the skin and superficial muscles totally burnt away. The right leg only partially attached to the thigh, and entirely converted into a soft, black, greasy and shapeless cinder, through which the finger could be pushed with ease. The left thigh and leg in a condition similar to that of the right extremity, but still attached to the foot, which was a charred and shriveled mass similar to the right foot. Not a vestige of clothing remained anywhere."

The following conclusions are drawn from the same source:

"1st. That the bodies of habitual drunkards, particularly if corpulent, are more than ordinarily inflammable, so that slight accidents, such as the upsetting of a lamp, or a spark from a pipe, may lead to the ignition and destruction of the body.

"2d. That in these cases the extent and gravity of the burns may be out of proportion to the apparent exciting cause. It has been noted in these cases that the combustion of the body may be almost total, while adjacent objects, such as furniture, may have been only slightly or not at all injured. Also, that the flame is usually difficult to extinguish. That women are more frequently the victims than men. The deposit of a peculiarly fetid soot upon the surrounding objects has been observed in most instances of this form of combustion."

CHAPTER XI.

WOUNDS

The subject of wounds is perhaps the most important one in the whole range of medical jurisprudence. The largest number of homicides, suicides, and accidental deaths are directly or indirectly traced to the primary cause of wounds. In fact, we can almost say that the majority of deaths that are of interest from a medico-legal aspect are due to wounds.

What is a wound? The surgical definition may be comprised in these words: A wound is a solution of the continuity of the soft tissues by violence or by mechanical force applied externally. Whereas the law says that *a wound is any lesion of the body,* and includes not only the solution of the continuity of the soft parts, but also every kind of accident, and it may include personal injuries, whether external or internal.

Casper says that a wound is "every alteration of the structure or function of any part of the body by any external cause."

These legal terms are far more comprehensive in their definition than the ordinary surgical interpretation, so that in surgery a sprain, or a dislocation, or a fractured bone may not be a wound, but in law it is included in the more comprehensive meaning.

Wounds are classified by various authors, but the classification depending upon their severity, with reference to whether they are fatal or not, is open to serious objection, for given the identical "non-fatal" wound in two individuals, the one may heal, and the other may cause death, either on account of the idiosyncrasy of the one, or the general health and condition, or even from the mental effect, or from other cause. A much better classification is based upon how the wound was inflicted. In its broader sense, that is, it includes the means by which and the manner in which the wound was inflicted.

We may have wounds that are open and wounds that are subcutaneous. The open wounds may be classified as: incised wounds where a cutting instrument has been used; punctured wounds, those caused by stabbing; and lacerated wounds, where the tissues are torn; and finally, pistol- or gun-shot wounds.

The subcutaneous wounds vary from a small contusion, as shown by an ordinary black-and-blue spot, to the severe sprains, dislocations and fractures of the bones, or even fractures of the various solid organs, such as the liver, etc.

INCISED WOUNDS

Incised wounds may be caused by any instrument, the edge of which is sharp enough to cut the skin, and here the sharpness of the edge is not of so great importance as is the force that is applied when the wound is inflicted, for dull instruments with sufficient force may cause sharply incised wounds. The weapons of this class vary from a razor to a piece of iron, glass, or even wood.

As a rule, the sharper the instrument the more cleanly cut will be the edges of the incision. When the incision is transverse to the muscular fibers below the skin, the wound tends to gape, while if the incision is on a line with the muscular fibers, there is only very slight retraction due to the elastic fibers of the skin. If the instrument had a straight or regular edge, the edges of the wound conform more or less closely to the shape of the instrument; but where irregular bits of glass, etc., are used, the edges of the wound are more apt to be irregular. When the skin is not tightly stretched over the part that is wounded—that is, when it is full or even folded upon itself, as in the flexion of the humerus in the axilla, or in the palm by flexion of the fingers—the edges may be very irregular, though the incision was made with a sharp instrument with a straight edge.

The direction of the incision can generally be determined by a probe, but only an approximate estimate of its depth can be obtained without careful dissection of the wound, so that it is generally possible to arrive at a definite conclusion in such cases only by a postmortem examination.

If the direction of a wound is perpendicular to the surface, the subcutaneous surfaces are symmetrical, and on cross-section appear like a V. If it is oblique, they will be more or less beveled, and the edge of the upper side will be sharper on account of the angle made by the blade of the knife with the surface of the skin. The edges of an incised wound tend to separate and gape, and show but little relation to the thickness of the blade or other weapon. The shape of the incised wound is usually fusiform; it is determined by the degree of gaping and by its depth in the center, with the middle portion generally the deepest. The severity of the wound depends upon its depth and the vessels injured, which may cause hemorrhage, and this is a distinction from the tearing or bruising that occurs in other wounds, such as contused ones.

The weapon that was used to produce the incised wound can also be fairly definitely determined. We may conclude that it has a cutting-

edge, and we can draw certain conclusions as to the sharpness of this edge from the clean-cut edges of the wound, but the weapon need not necessarily be a knife. Contused wounds caused by certain instruments may closely resemble incised wounds made with a knife. In fact, such wounds may be made upon the head where the bone is close to the surface, by a club, stick, or even the fist. But on dissection of these wounds it is noticed that they are not symmetrical, and the cross-section is not V-shaped, but it is more or less filled with tissues that have escaped injury or division, and there is more or less infiltration and extravasation into the neighboring tissues.

Larger instruments, such as axes or hatchets, may produce incised or punctured wounds, but in these cases the wounds are much deeper than ordinary incised wounds caused by a knife, and such a wound approaches in its character a penetrating or punctured wound. Here generally the added violence and greater weight of the implement increase the severity and gravity of the wound. These hatchet wounds are generally easily recognized, and are so characteristic that often a great deal of information can be obtained from them; the length of the cutting-edge may be made out from the external length of the wound, and the depth of the wound depends upon the amount of violence used. This was well illustrated in the murder of the Bordens in Fall River in 1892.

PUNCTURED WOUNDS

Punctured wounds are those that are caused by pointed weapons where they are thrust into the tissues rather than drawn across the surface. Punctured wounds, therefore, have a greater depth than incised wounds and less superficial length. Such weapons usually have a sharp point and a single or double edge to the blade. The external wound is modified to a certain extent by the nature of the weapon. If made with a double-edged weapon there is formed a slit the edges of which are clean-cut and slightly separated at the middle.

Punctured wounds from the thrust of a single-edged knife-blade produce wounds similar to those of double-edged weapons, such as a dagger. Unless the back of the knife is very broad the superficial appearance of the wound is not likely to differ from those made by a double-edged weapon, for the point of the knife impinges upon the skin and produces a result similar to that of a dagger thrust. So that it is often difficult to distiguish whether a single- or a double-edged weapon has been used.

This similarity of the two ends of the external wound does not continue where the thrust has been made through a solid organ, or through bone. In the latter case, if the bone has been penetrated by the thrust it will leave, as a rule, evidence as to whether a single- or a double-edged

weapon was used, and in these cases we may often determine the width of the blade, its thickness, and sometimes the nature of the weapon and the manner in which it was thrust. Other weapons, such as the bayonet, make a more or less irregular wound which may be stellate in appearance. Weapons with a blunt point or a blunted edge do not cut the skin, although they may penetrate it; they simply push apart the subcutaneous tissue, acting like a wedge.

Further, the appearance of the external wound is variable, depending upon whether the skin was tense or lax when it was injured. Also the angle to the surface at which the weapon is held modifies the appearance of the superficial wound. So that a knife-blade may make a curved cut, or if the skin is loose the opening may be more or less triangular. If a sharp-pointed instrument without a cutting-edge is thrust into the tissues, the wound is generally smaller than the weapon on account of the elasticity of the skin, whereby the fibers are simply pried apart, and after withdrawal of the weapon tend to approximate. But if the instrument has a sharp edge, the superficial wound may be longer than the width of the blade, especially if the thrust was not made at a right angle to the surface of the body and if the instrument was not withdrawn in the direct line in which it was inserted.

All punctured wounds tend to gape at their edges, no matter how thin is the blade. The edges are often everted, due to the withdrawal of the weapon, and if the weapon had a rough surface, such as caused by rust, the amount of eversion may be considerable. Bits of glass or crockery may cause severe punctured wounds. Here the irregularity of the cutting-edge causes wide variation in the external appearance of the wound.

The solid tissues and organs of the body afford more or less evidence as to the nature of the weapon and the manner of its use, though here the direction of the stab and the force used may alter the appearances somewhat. In cutting muscular tissue there is a difference according as to whether the wound passes transversely or parallel to the muscular fibers. Where the abdominal organs are penetrated, it is not always possible to determine the depth of the wound, especially if several punctures have been made in the stomach and intestine. The difficulty arises from replacing the organs postmortem in the position they were in when the wound was inflicted. But where the wound has been made in the solid tissue or organs, the depth of the wound can generally be determined. But to say whether a given instrument could have caused a particular wound is not always possible. The blade may be longer than the wound is deep, and it is also conceivable that the wound may be deeper than the length of the knife-blade, for the thrust may have been up to the hilt, and further force may have caused a temporary concavity of the surface of the body which is normally convex. Where

such a wound is measured at autopsy from the normal convex position of the surface, such a wound may be found deeper than the given blade is long. This is especially true where great force has been exercised.

The hemorrhage from punctured wounds is not extensive, at least externally, except in the neck and also in the female genitals. Internally, the hemorrhage will depend upon various circumstances. If a large blood-vessel has been cut, the severity of the hemorrhage will, of course, be according to the vessel injured. So far as the internal organs are concerned, inasmuch as they are out of reach, the hemorrhage is much more profuse than from a corresponding superficial wound. Small punctures of the liver, spleen, or lungs may result fatally from the hemorrhage which is uncontrollable. Where the wound has been made by a pointed instrument, but which has not sharp edges, if the point avoids injuring the vessels, the hemorrhage is generally not so severe, as the tissues have been more or less pried apart, without necessarily cutting them.

A rounded instrument may not produce a round opening, for the skin separates in its line of least resistance. Punctured wounds in the extremities tend to assume an elongated shape. In the deeper tissues the wounds may vary in appearance, due to the direction of the fibers of the various layers.

LACERATED WOUNDS

Lacerated wounds are generally produced by tearing or crushing, as when a person is caught in shafting or other machinery. They may also be caused by blunt weapons or even by falls. They are generally irregular in shape, and there is extensive extravasation of blood and wide contusion in the adjacent tissues. They rarely give any indication of how they were inflicted. They may in certain cases simulate incised wounds from their direction and character, but their edges are much less sharply defined and the contusion is characteristic. Lacerated wounds caused by falls generally occur where prominent bony processes are not well covered with adipose tissue.

Lacerated wounds caused by machinery are often very extensive, as seen in the frequent injuries to employees, especially women, whose scalps are torn from their heads by the belting, or where the hand is caught between rollers or cogs, and the fingers and tendons even up to the elbow are pulled out. In these cases there is usually very little loss of blood, although large vessels may have been injured.

Agnew reports the case of a man who had his arm torn from its socket at the shoulder, and who went about for five days without surgical treatment, showing his injury for the price of a drink.

CONTUSED WOUNDS

Contusions form one of the largest class of injuries requiring medical investigation in cases of violence. They may be produced by almost any means, by anything with which a blow may be struck, and it makes no difference whether the body was struck by something or whether the body strikes something, the effects are the same in kind, at least. So that there is a very wide diversity in the form and degree of the injuries caused by contusions. The results or effects that may be produced by a blow are rarely seen as a solitary lesion; generally there are other effects, according to the degree of force used, the direction of the blow, and the region where the blow was struck, such as seen in fatal blows over the epigastrium which may arrest the heart's action, without giving any indication at postmortem examination of the force of the blow or where it was struck.

Further, extreme force or violence may be inflicted and only superficial injuries be noticed upon the skin, and yet the various solid organs may be ruptured, as well as the hollow organs, or even the bones fractured. The elasticity of the skin is the cause of this discrepancy. Taylor mentions the case of a girl who was struck in the abdomen by a stone. No external mark of injury was found, but there was immediately great pain, followed by collapse and death in twenty-four hours. Postmortem it was found that the liver had been ruptured, and the contents escaping into the peritoneal cavity had set up general peritonitis.

Draper reports the case of a man who was struck by a locomotive and died two hours later. The only visible external lesion was a small bruise over the right hip and a fracture of the right humerus. On postmortem examination five ribs were found broken, the lungs were bruised, the liver and right kidney were crushed and disorganized, and there was extensive extravasation of blood in the right lumbar region. And still another case where a man was caught by a heavy rope and crushed between the cable and sides of a steam car. There was a slight, scarcely visible bruise between the shoulders and an indistinct bruise on the abdomen. Internally, the autopsy revealed 18 ounces of fluid blood in the abdomen; the liver, left kidney, and pancreas were extensively crushed, the lungs were bruised, the sternum broken, and five ribs on the right side and nine on the left were broken. So that we have many instances where fatal injury may occur without leaving any particular marks externally, although usually blows with a blunt weapon will leave some evidence of their being dealt.

Where there has been extensive extravasation of blood into the subcutaneous tissues and adjacent soft parts, the term ecchymosis is com-

monly used; its cause is the rupture of the capillary blood-vessels and the escape of the blood into the surrounding tissue. Externally, they are marked by swelling and discoloration. They may be produced by pressure or by blows of sufficient force to crush the capillary walls. Where there is resisting or solid tissue, like bone, beneath the skin, they are more likely to occur, and the force necessary to produce them is much less. Regions that are well supplied with blood-vessels and where the tissue is of loose texture are particularly liable to exhibit ecchymoses. But there is a great difference in people in their susceptibility to the so-called black-and-blue spots. Hence, too, the part of the body struck shows a wide difference in the effects. A blow on the head generally results in the formation of ecchymosis almost immediately, accompanied by heat, pain, and swelling, but there are some people who may not even here show the effect of a blow.

The appearance of the black-and-blue spots may be long delayed from a deep-seated injury, so that superficial discoloration is not conclusive as to the extent of the injury or to the degree of force exercised. On the other hand, the ecchymosis may be out of all proportion to the actual injury done to the tissues, as seen in a sprained ankle. Where a blow is followed by a fatal result, the ecchymosis may not appear until after death, and it is not necessary that a person should survive in order that ecchymosis may appear as the result of a blow. These postmortem ecchymoses are to be sharply differentiated from the postmortem lividity and other discolorations that occur naturally. These black-and-blue spots, often purplish in color, rarely crimson, gradually begin to change in color. They become lighter and later greenish and yellow, beginning at the outer edges, the center of the spot being the last to disappear. Only an approximate idea can be formed as to the age of the bruise from the color and appearance of the contusion. Yet the injury depends upon the depth of the effusion and upon the extent of the extravasation of blood. Where the injury is superficial, the ecchymosis is almost immediate in its appearance; where it is deeper, it may be a long time before the color at the surface appears. Here, too, the degree of force and the age and general vigor of the patient will exert some influence.

Dr. Draper makes a general statement in regard to color changes as follows: "At the end of from eighteen to twenty-four hours the margin takes on a lighter hue. For two days (up to the fourth day) it is violet; then green for two days (the fifth and sixth); then yellow on and after the seventh day until the total fading out, about the tenth or twelfth day or later."

So that at best we can only say that if it is green or greenish-yellow in color, it was inflicted at least forty-eight hours previous, but beyond

this it is unsafe to give more than an approximate opinion. The nature of the blood within the contusion may occasionally assist us in forming an opinion. The older the injury, the thicker is the blood and the more pronounced are the changes in color.

The contusion often resembles in its form the object that caused the lesion. The sharply defined linear streaks that are produced by the whip are easily distinguished. Starkie cites a case where "In an attempt at murder, the complainant, in his own defense, struck the assailant violently in the face with the house key . . . and the ecchymosis which followed this contusion corresponded to the wards of the key; and it was chiefly through this very singular and unexpected source of evidence that the criminal was afterward identified and brought to trial."

Contusions may be followed by destruction of the parts involved, so that we may have a wound which may be called a contused wound. The variation of such wounds, both in shape and severity, is almost endless. Usually there is very little hemorrhage; the edges of the wound are crushed, uneven, and bruised, with much infiltration of the surrounding parts.

The nature of the weapon that was used is often very difficult to determine, and in the great majority of cases the most that can be said by experts is that such and such a wound may have been caused by such a weapon that may be offered in evidence or one similar to it. But no exact description of the weapon is possible, as has been stated in the previous paragraph. There may be, however, other circumstances of evidence that will serve to identify the weapon, such as a bit of wood or a fragment of the instrument.

Bites and similar injuries, whether human or animal, also belong to this class. As a rule, the bites of animals are more severe than those of man. In these cases the edges of the wound are fairly clean cut and occur only on the parts of the body exposed to the attacks of these agents, such as the face and hands.

Severe and even fatal injuries may attend contused wounds. This is seen in the effects upon the internal organs that are produced by crushing, kicks by men or animals, and falls from a considerable height. In these cases there may be but slight evidence externally of the serious nature of the wounds within, which may involve rupture of the solid organs or the coverings of the hollow organs. Casper says: "Healthy organs never rupture spontaneously, and even considerable force is required to rupture them when they are in a healthy condition. Therefore, if at an autopsy an organ otherwise sound is found rent and ruptured, it signifies great external violence."

Hofmann classifies the organs in the following order in regard to their

liability to rupture: Liver, spleen, kidneys, lungs, and heart. More rarely the stomach, intestine, urinary bladder, and brain. We see, therefore, that the situation and nature of the organ affects its liability to a certain extent. The liver, normally large and more or less exposed, is peculiarly liable to rupture from this sort of injury.

The tremendous force, such as is seen in railroad accidents, produces the severest kind of contused wounds. Limbs may be torn off and the soft parts of the body reduced to small fragments, and even bones finely splintered. Such injuries may be produced also by machinery, where the workers, by accident or carelessness, are caught in the machinery and parts of their bodies ground up, or they may be carried along by machinery and hurled against the walls and ceiling with great force.

Draper cites an interesting case showing the remarkable elasticity of the skin. A man fell upon the railroad track and the wheels passed over his neck. The subcutaneous tissues, including the vertebral column, were divided, yet the skin was only bruised and not penetrated at all. The same author quotes a case showing the terrific force of high explosives, and the utter annihilation of the body as a result:

Three men in the employ of the United States Engineers were engaged in moving some of the harbor mines which, having been planted for defence in the harbor, were being taken from submarine beds to be unloaded. The charges consisted of 250 pounds of dynamite and gelatin, mixed so as to make a highly explosive compound. The men had three of these on a low dray drawn by one horse. When last seen, one of the men was driving, the others were on the cart. In some mysterious manner, which will never be known, something happened which exploded the mines, and the result was almost outside the bounds of credibility. The three men were absolutely obliterated. The most careful search failed to find more than a few mutilated fragments of the smallest size. An index finger, the sole of a foot, with two toes, a bit of intestine, a lock of black hair, a small section of a spinal column, and a little piece of liver, all the fragments scarcely amounting to a peck in measure, these were all that was left of three men—no other parts, bony or otherwise, were found. Such complete annihilation in a second of time attested the enormous force of the explosion.

GUN-SHOT WOUNDS

These include all wounds made by the discharge of any kind of a missile from a firearm by means of explosives. It includes all kinds of firearms, from the heavy cannon to the toy pistol, and the class of missiles, from the large cannon-ball or shell to the small bird-shot. Injuries from the larger missiles occur under such circumstances that they would not be confused with injuries from smaller arms. Wounds from small

bird-shot are generally so characteristic that they are not easily mistaken. In these cases it is often important to determine as exactly as possible the distance at which the weapon was fired. Ordinary fowling-pieces are seldom fatal when fired beyond 100 yards. If such a gun is fired from within a foot of the body it produces a single wound at the surface, though the shot may diverge in the deeper tissues. In such cases the wound is of considerable extent, its edges are ragged, contused, and blackened, and there may also be great laceration and injury to the deeper parts. Where the body is protected by clothing, the character of the wound is modified: the shot is more or less scattered, and even when the firearm was fired at short range the shot will not enter the body in one large wound, but in several smaller ones.

Bullet wounds from a rifle or revolver vary widely according to the kind of bullet used. The modern army rifle of the United States, as well as that of Great Britain, is of small caliber and discharges the bullet at a high rate of velocity. The bullets are from 6.7 to 8.2 mm. in diameter, and from 30 to 32 mm. in length, and weigh from 10 to 16 grams. They are capable of inflicting a mortal wound up to a distance of 5000 yards. The perforation of the entrance wound is characterized by fairly clean-cut edges. If the bullet meets a bone, it passes through with a clean cut. If the weapon is fired at short range the effect is somewhat different, that is, it is more explosive; bones are shattered, and the solid organs, such as the liver, kidneys, and spleen, as well as the hollow organs, as the bladder and stomach, are ruptured. These bullets generally pass through the body in a straight course, and are rarely deflected even by striking a bone.

Rifles using bullets of larger caliber, 0.32 to 0.48 of an inch, produce results similar to those of revolver bullets. These bullets produce a depressed wound; the entrance wound is smaller than the missile on account of the elasticity of the skin, so that but little can be determined from the size of the orifice. Wounds from a 0.32 bullet will generally permit the passage of a large probe, while a 0.22 leaves only a very small hole which is barely visible. The wound is more or less circular in outline with frayed edges; the surface gives the appearance of being punched out, due to the actual loss of tissue; the edges of the wound are thickened and ecchymosis extends from the surface for an inch or two. The edges of the wound are generally black, but not burnt, the darkening coming from the surface of the bullet and not from the powder grains. The course of these bullets through the body varies on account of the deflection caused by the firmer tissues. Occasionally the bullet may be cut in two by hitting a sharp-edged bone, but, as a rule, the bullet itself is deflected; it may follow the course of the fascia for a considerable distance. The arteries and nerves will also deflect the bullets, while veins

are more apt to be severed. These bullets cause much greater injury and laceration of the tissues than the jacketed bullets, because they are more easily deformed and because their velocity is so much less than the high-velocity bullets that there is greater deviation. The exit wound is generally larger than the entrance wound, though it may be smaller than the missile. The edges of the exit wound are more apt to be everted in distinction from the inverted edges or punched-out appearance of the entrance wound. There is no sign of burning or of powder grains, although the edges of the exit wound may be bruised. It is difficult to describe these exit wounds, as they vary so widely, but the above is the usual appearance. The relative size of the two wounds, the entrance and the exit, is of some assistance in determining the direction in which the weapon was fired, but as to the position of the body when wounded a positive conclusion can seldom safely be drawn.

The well-defined outline of the entrance wound, as compared with the ragged, stellate, and lacerated appearance of the exit wound, are much more likely to assist in the determination of this question. The angle at which the missile strikes the body can be more or less determined from the appearance of the entrance wound. If fired at an acute angle to the surface of the body, the entrance wound is more apt to be oval or linear, rather than circular. The conical bullet may change its direction slightly so that it would produce an oval wound.

If the weapon is discharged in contact with the body or in its immediate neighborhood, the wound is large and circular and the skin blackened and burnt. This latter differs from the blackening caused by the entrance of a bullet from a distance on account of the presence of powder grains in the tissues. The hair, as well as the skin, may be singed and even the clothing that covered the injured part. The bullet itself does not burn the tissues, as it cannot by any possibility attain enough heat; but the powder may burn, as it may be fired or even explode after it has become imbedded in the tissues. Where exploded powder grains are found in the skin, it is evident that the weapon was held at close range. The black specks of powder are arranged thickly around the entrance wound, becoming more or less scattered farther from the wound. These powder-marks are best seen when the wound is unprotected, but they may also be seen to a lesser extent when there is a light covering over the skin. Heavy clothing generally obliterates them entirely.

In firing a revolver with the muzzle close to the body there is apt to be a slight burn or scorching immediately above the entrance wound. The reason why it is not more marked at the entrance wound is due to the slight recoil of the weapon.

These tattoo-marks from the powder grains are, as already mentioned, conclusive evidence of close range, that is, probably within three feet,

Casper says. But in any given case it is better to experiment, using the same weapon and similar bullets as did the suicide or homicide, in order to determine definitely the distance. The absence of the powder grains, on the other hand, is no proof that the shot was not at close range. This may be due to a variety of conditions, such as using smokeless powder or other explosives of similar character.

If the muzzle of the weapon is held firmly pressed against the surface of the body, and the weapon fired, there may or may not result serious injury. Often it happens that on account of the resistance of compressed air within the muzzle that the bullet loses its velocity and falls harmlessly to the ground. Occasionally in these fool-hardy experiments where one tries it upon himself as a joke, the barrel of the weapon bursts, but if the barrel and mechanism is so tight that none of the generating gas can escape, it may produce severe laceration of the surface.

Blank cartridges may cause a hole in the skin when fired close to the body, and also show evidence of powder-marks. These wounds may cause severe laceration and may penetrate to a considerable distance beneath the surface when fired at short range, and in some experiments the wadding passed between the ribs into the thorax, and in one case, even carried away a portion of the rib.

The person's clothing may catch fire from the too close discharge of a shot-gun or other missile, but in the case of small arms the distance is probably within a foot.

Gunpowder itself may produce fatal wounds. When a weapon charged with gunpowder is fired at a body which is uncovered, at a short distance, a blackened and somewhat lacerated wound is produced. If the powder grains are large enough they may give the appearance of injury by small bird shot. The singeing of the hair, the burning of a portion of the clothing of the person, and the tattooing all indicate that the weapon was fired at a close range.

Several external wounds may be caused from a single bullet. Numerous instances have occurred where the bullet has entered a body, emerged, and entered again, giving the impression that more than one bullet was fired. Or the bullet may have entered some obstacle in its path before striking the body and have been broken or split into two or more pieces. In this case there will be as many wounds as there are pieces striking the body, and each will take its own path.

Bullet wounds are generally so characteristic that they are not confounded with other forms of wounds.

As to the track of the bullet, the appearances vary widely according to the tissue that is injured. A bullet passing through a muscle makes a canal which is more or less ragged along its edges, bruised and bloody,

and often larger than the bullet. In its course we find bits of clothing that have been carried into the wound if the bullet struck the body where it was covered.

Draper cites an interesting case where a revolver shot carried a gold

FIG. 4.—A BULLET WOUND FOLLOWED BY RECOVERY.
The tube shows the course of the bullet.

link from a watch chain into the thorax, where it was subsequently found in the nose of the bullet.

Where the bullet strikes a bony surface, such as the skull, great variation may be seen in the effects. If the bullet is travelling at a high rate of velocity it causes a more or less punctured wound, and the inner

edges of the skull are beveled. This latter point is of great value in determining which is the entrance wound and which the exit wound where we have a perforated wound. Occasionally the bullet, after entering the brain, may strike the opposite side of the skull with insufficient force to penetrate, but with enough force to rebound, in which case we may find the bullet in the same side of the head as the entrance

FIG. 5.—SIDE VIEW OF FIG. 4.

wound, but there will be two wounds or tracks within the brain tissue. In these cases the path of the bullet through the brain is much larger than the bullet itself; it is more or less blood-stained and bruised and the brain tissue in the neighborhood shows much ecchymosis and many small hemorrhages. If the bullet strikes the skull after most of its force is spent there will be a comminuted fracture of the skull, with fissures in all directions.

A bullet may change its shape by coming in contact with a bone or other resistant surface, and in these cases the injury done by a misshapen bullet might be very severe. Bullets are easily deflected from their course by striking any resistance, such as a bone or fascia. The finding of a bullet is often very difficult on account of this change in its course after it has entered the body. Many remarkable examples are mentioned by various authors of the erratic courses of bullets in the body. One case is reported where a bullet entered the front of the neck, glanced at the side of the thyroid cartilage, and traversed completely around the neck, finally ending under the skin over the larynx; another case where it entered the breast and was found in the scrotum. It had passed around the skin of the abdomen without penetrating the latter.

WOUNDS IN THEIR RELATION TO VARIOUS PARTS OF THE BODY

The danger of wounds and their influence in causing death are two points which must be especially considered by the medical witness, and this can best be studied by taking up the injuries of wounds to the various regions and parts of the body.

Wounds of the Head

Scalp wounds of the incised variety are rarely fatal unless they are very extensive. Contusions, especially when accompanied by much laceration, are dangerous on account of their tendency to septic erysipelatous inflammation. Punctured wounds, though slight, may sometimes cause death on account of the inflammation and suppuration as a result of infection. On the other hand, there are many records of persons, especially women, who, being caught in machinery or shafting, have had their scalp torn from the head, and yet have recovered from the effects and even have had a new scalp by grafting the skin of others upon the wound. So that the medical witness should be cautious and give a guarded prognosis.

Wounds of the head, which in themselves may be slight and of little consequence, may, on account of the injury to the brain, produce very serious or even fatal results. It is impossible to predict from the external appearance of the wound the amount of injury done to the tissues within, and here the brain shows a wide variation in its susceptibility to accident. The slightest contusion may be followed by fatal results; but on the other hand, severe fractures, even involving depression of the bone and loss of the brain substance, may be followed by complete recovery. Further, a person may recover apparently from the first effects of the wound upon the head, and later, after some days or weeks, become worse and suddenly die.

Postmortem it will usually be found that the brain is considerably

disorganized by suppuration, though no evidence of this condition was manifested, except, perhaps, just before death. In such cases the medical witness must be cautious, and determine as definitely as possible whether suppuration was caused as a result of the blow or wound previously inflicted, or whether the suppuration developed of its own accord.

Concussion.—Concussion is the common result of the effect of a blow upon the head. This may or may not be accompanied by extravasation of blood. The symptoms are fainting, insensibility, and, occasionally, immediate death. If the blow is severe enough the person drops in his tracks and may die on the spot, or he may linger in a state of insensibility for days and even weeks, and then die. There may be more or less vomiting, especially when consciousness is about returning. This sudden death that may result from concussion may also result simply from the shock to the central nervous system. There may not be any evidence of a blow upon the body or only, perhaps, a very slight, superficial bruise.

Occasionally the symptoms resembling concussion are not immediate. They may come on after a few hours or even days after the previous injury. In the meantime the person attends to his usual vocation, but suffers from increasing headache, vertigo, and confusion of ideas; there is occasionally paralysis, and here the result may often be fatal.

Intoxication Distinguished from Concussion.—An intoxicated person may exhibit symptoms similar to those produced by a blow upon the head. If the history can be obtained, that will generally settle the question, but unfortunately this is not always possible, and the physician must rely on other symptoms. The odor of the breath is not of much value as evidence, for the man may have had one or two drinks, and sustain concussion of the brain, and not be intoxicated. Or a man may have had administered to him a stimulant as a first aid after his injury. If there is no alcoholic odor to his breath then the case is presumably concussion. Pressure upon the supraorbital nerve has been recommended as a means of differential diagnosis, it being stated that if a person is intoxicated he will scowl, whereas, if he has concussion of the brain, he is insensible to this stimulation. Where there is doubt it is better to proceed on the idea that it is concussion rather than intoxication. Many cases have occurred where the diagnosis has been simply intoxication, and the man has been allowed to sleep in his cell to sober up, and he has been found dead later from the effects of concussion.

Postmortem it is often difficult to distinguish whether there has been concussion of the brain or that the person was intoxicated. There may be evidence of a blow upon the head, but this is of such variable degree that, unless marked, it is of little value in aiding a positive opinion. The

vessels of the brain are congested whether the person is suffering from concussion of the brain or is intoxicated. The detection of alcoholic stimulants in the stomach may lead to the presumption of intoxication, even though there is a noticeable bruise upon the head. In general it may be said that a sharp differentiation from the postmortem appearances is impossible. The ultimate decision must rest upon circumstantial and other evidence.

A blow on the head may cause an effusion of blood either upon the brain surface or within its substance, which may cause death. A person thus struck generally falls and death occurs shortly. The question may arise whether the person died from the blow or from the fall. The effusion commonly arises from the violent concussion which the person sustained by the fall. If the fall has resulted from accident, and not from a blow, then there is no question of crime; but if the fall was succeeded by a blow then the medical witness may be compelled to admit that the effusion took place either from the blow or from the fall. The effusion may take place slowly and not produce symptoms for some time and these may prove fatal. It is not always possible in these cases to determine whether the concussion may be attributable to an effusion resulting from the blow or other accident occurring some time previously.

In those past middle life, death may come from effusion of blood, but the effusion here may be caused by a rupture of an artery due to its diseased condition. Such cases of apoplexy are uncommon under forty years of age. Occasionally such cases have been wrongly attributed to violence. The most we can say is that when the marks of violence are slight the witness should be cautious in asserting that the effusion was produced by a blow, especially when the deceased was known to be intemperate. Many cases are recorded where the main question has turned upon the cause of effusion on blood in the brain. In some the medical witness has been made to acknowledge that temper, or mental excitement, or drunkenness was the sole cause of the effusion, where there was evidence of extreme violence, sufficient to have undoubtedly produced fatal results upon a person taken by surprise or upon an intoxicated person. Undoubtedly excitement and intoxication may be considered as predisposing causes, but cannot be considered the immediate cause of a fatal hemorrhage.

Occasionally the brain lesions do not correspond in situation with the external lesion. They may be on the opposite side of the brain from where the blow was struck. This is particularly apt to occur where fracture of the skull is made without any depression. A blow upon the top of the head may produce congestion at the base of the brain where a slight degree of compression is speedily followed by death.

Wounds of the brain itself may or may not prove fatal. Where the

wound does not prove immediately fatal, danger from sepsis is most to be feared, and as this proceeds slowly in the brain tissue, life may be prolonged for a considerable period. A remarkable case of a penetrating wound of the brain is that of Gage. He was preparing to blast, and tamping a charge of powder in a hole in a rock. He was using a bar an inch and a quarter in diameter and about three feet and seven inches in length, which weighed a little more than thirteen pounds. Gage was standing over the bar, and in some manner the charge was set off. The bar was driven through Gage's head. It entered under the left zygoma and emerged at the top of the head to the right of the middle line. The central part of the left anterior lobe and a portion of the right parietal region was carried away, and the lateral ventricle and longitudinal sinus opened. He was able to speak in a few minutes after receiving this injury. He returned home without much assistance, retaining his memory perfectly, and was able to give an account of what happened. He fully recovered his health, except the loss of the left eye, and lived for many years afterward.

Such cases are rare and improbable, though the medical witness cannot say impossible, and should be cautious in giving an opinion as to the effect of punctured wounds in the brain.

Wounds of the Face.—These wounds, if of any extent, are generally succeeded by a considerable deformity, and when they enter the cavities in which the sensory organs are situated they are often fatal on account of secondary inflammation of the brain. Wounds that appear only slight externally may have caused deep-seated injury. For instance, a wound may be made upward through the eye-lid and perforate the orbital plate of the frontal bone and thus injure the brain without being apparently serious externally.

Wounds of the eye itself may interfere with or destroy the vision of not only that eye, but if the injury extends to about 5 mm. outside of the edge of the iris there may be loss of sight in the other eye as the result of a sympathetic ophthalmia. Total blindness may follow a wound which is not apparent on the surface. Such blindness may be caused by destruction of the optic nerve either by a bit of bone or by compression of the nerve in a blood-clot. Injuries through the eye may inflict serious injury upon the brain and cause death.

Injuries to the ear are often followed by deafness. Here we must guard against a false claim, as often set up, that deafness is the result of an injury. The deafness may have preexisted without being noticed, and careful examination should be made for evidence showing its existence before the alleged injury. If the rupture of the tympanum appears to be recent, and there is also ecchymosis of the neighboring parts, then the cause may be a recent accident. Rupture of the tym-

panum may be due to direct violence by an instrument thrust through it or by indirect violence, by a compression of the air in the auditory canal from a blow upon the external ear. It must not be overlooked that the sense of hearing is not entirely lost in all cases of ruptured tympani, for many people have a perforated ear-drum, whose hearing is normal.

Wounds of the neck may produce serious results on account of the injury to the blood-vessels which it contains. Incised wounds, which are generally suicidal, though occasionally homicidal, are the most frequently found in this region, but there may be punctured wounds as well, resulting in death from the downward course of a dagger or other instrument penetrating the carotid artery. Blood may trickle into the trachea or larynx if that is wounded, and cause death by asphyxia, or the same result may be brought about by edema of the glottis. A severe blow upon the larynx may cause death from shock or from arrest of the respiration or this may simply result in suspension of consciousness.

Injuries to the Spine

The spine, or at least the nervous tissue within the spinal column, is liable to concussion or to effusion or compression, either from extravasation of blood or from fracture of the vertebræ. The degree of violence necessary to produce such an injury is considerable, as is easily understood from the strength of the spinal column. Such injuries are generally of the nature of contusions, and occur from falls and blows. Fractures of the vertebræ are generally attended by displacements, thus producing compression of the spinal cord. The higher up they occur, the more rapidly fatal, as a rule. The body becomes paralyzed below the seat of injury as a result, and if the compression is above the fourth cervical vertebra death, as a rule, comes on speedily, for asphyxia results from paralysis of the nerves of respiration. Occasionally the spinal canal is injured by a punctured wound, when the dagger or other weapon enters between two vertebræ.

Dislocation of the vertebra has often been caused accidentally and followed by fatal results. Taylor cites several such instances. One, where a lunatic suddenly threw back her head to avoid taking some food that was offered her, and she fell dead, evidently from the compression produced by the sudden displacement of the dentiform process of the second vertebra. And another where a woman alive at one o'clock in the morning, was found dead at four. Here the dentiform process of the second vertebra was found to be displaced, and this had injured the spinal marrow so as to destroy life.

There is another kind of injury to the spine, which, though not of criminal interest, is of very great importance medico-legally from its

occurrence in several cases; that is, the so-called "railway spine". Here, as the result of railway accidents, there may be caused the most trifling external bruises upon the back, and it may be claimed that concussion of the spinal cord occurred, which has caused serious symptoms attended with an unfavorable prognosis.

Medical authorities have vied with each other on this question of the severity of this class of injuries. Erichsen was the first to recognize the severity of such accidents, and in 1866 published a book upon the subject. In 1882 Page combated the statements of Erichsen, and those of the medical profession devoted to nervous diseases are generally to be found as followers of one or the other. It cannot be said that either side is correct in the position that they take. The opinion in such cases is largely a matter of guess-work as the lesions cannot be demonstrated until autopsy. In other words, the symptoms are subjective and not objective. There is no question but that fraud enters into a large number of these cases where damages are claimed for injuries, and the question is decided more by the skill of the opposing lawyer than by the merits of the case. No doubt there occur true cases of injury followed by a long train of increasing symptoms, and the disabling of the victim from pursuing his natural vocation, and causing him much physical pain, but these are probably not so very frequent.

A medical witness should exercise great caution in expressing an opinion as to the real injury in such cases, and should not be a party to any extortion or fraud.

Wounds of the Chest

Wounds of the chest may be divided into two classes, those which involve the walls only and those which penetrate the thoracic cavity. When they are limited to the walls alone, they are rarely followed by serious consequences. Such wounds generally are incised or punctured wounds. There is but slight bleeding and the wounds heal readily, as a rule. Contusions of the chest are dangerous according to their severity. If the violence was sufficient to fracture one or more ribs and to drive the sharp ends into the lungs, or if the violence was sufficient to rupture the lungs without fracture of the ribs, the danger may be great and the prognosis unfavorable; also when there has been profuse hemorrhage and inflammation of the lungs with or without suppuration. Fracture of the upper ribs is, as a rule, more serious than of the lower, as it implies generally a greater amount of violence. Simple fracture of the sternum without displacement is rarely attended with danger, but usually such fractures are attended by such force that there is concussion and other more serious lesions in the deeper tissues. When the ribs are depressed as the result of fracture, the thoracic viscera may be fatally injured.

Wounds of the Lungs.—The chief danger from wounds of the lungs is hemorrhage which is proportionate to the size of the vessel injured. When one of the large pulmonary veins or its principal branches are injured, a fatal result may speedily ensue. The extent of the external hemorrhage is no indication of the severity of the wound, for the blood may collect within the thoracic cavity, and thus cause compression of the lungs, producing asphyxia. Incised wounds are more dangerous than punctured wounds for they are more likely to be accompanied by hemorrhage, and the possibility of the escape of air is greater. Severe wounds of the lungs may be recovered from by surgical interference, but punctured wounds of this class generally give an unfavorable prognosis. Emphysema, pneumothorax, hydrothorax, and even empyema and permanent contraction of the injured thorax may supervene.

Wounds of the Heart.—These are among the most fatal of the penetrating wounds of the chest. It used to be considered that these wounds were necessarily and instantly fatal, but though they are always serious, they are not necessarily mortal, and in recent years surgical interference has prevented a fatal issue from wounds that formerly would have been mortal. Extreme violence or pressure may cause rupture of the heart and death from hemorrhage and interference with the heart's action. Occasionally rupture of the heart is the consequence of a preexisting disease, and this must be borne in mind where we meet with a case of death following a blow upon the heart, as in a quarrel. Here the previous excited stage under which the victim was laboring may have caused a previously weak heart to rupture, and the blow may have been the indirect cause of hastening the man's decease.

Punctured wounds of the heart, as already mentioned, are serious, though not always fatal. Wounds that enter the heart cavities are more serious than those which merely injure the heart muscle. The former are almost always immediately fatal, although cases are recorded where a person has survived even this form of injury. One case is recorded of a man who was shot during the Civil War in 1861 in the left chest, and the bullet passed through the left lung and into the left ventricle. The man recovered, and at autopsy in 1898, the bullet was found in the man's heart.

The duration of life after injury to the heart depends upon the location of the injury. The wounding of the right ventricle is not only the most common, but is the most fatal. Injury to the heart muscle by incision or puncture is subject to the same condition as other muscular tissues; that is, if the wound is longitudinal in the direction of the muscular fibers much less injury and harm is done than when the wound is inflicted transversely to the muscle. In this latter case the hemor-

rhage is immediate and far more severe, and death almost immediately results. There are numerous cases on record of severe injury to the heart cavities which would seem to be necessarily fatal, but which have been recovered from. One, where a bullet passed through the right ventricle, opened the left ventricle and passed out of the left auricle, and became encapsulated in the lower lobe of the right lung. The patient lived for thirty-eight months. Another case is recorded where a man was stabbed in the heart and lived for nineteen years. At autopsy there was found a scar in the right ventricle about 3 cm. long and one in the ventricular septum of the mitral valve.

The principal danger, then, of wounds of the heart or pericardium is not the severity of the wound or the hemorrhage, but the rupture by which the pericardial sac is filled with blood, thus preventing the heart's action.

Wounds of the large vessels of the thorax are for the most part fatal. Here death is caused both by loss of blood as the result of the hemorrhage and from the pressure of the blood upon the vital organs.

Wounds of the Abdomen

These show some of the severest results of violence. Blows upon the abdominal parieties are often accompanied by very severe results, even when only ecchymosis appears. In these cases the blows upon the abdomen, often called by the laity "blows upon the solar plexus" or "knock out blows", depend in their results upon other conditions, such as whether the intestine and stomach are full, or whether a considerable length of time intervened since the previous meal. The severer injuries are produced when the stomach and digestive tract are distended.

We may have severe rupture of the internal organs following such blows, or we may have injury to the subcutaneous tissue, as rupture of the abdominal muscles and contusion of the soft parts, with extravasation of blood.

Rupture of the diaphragm is usually caused by some great external violence and is generally associated with serious lesions of the other organs, although it may be ruptured alone; in these cases it is not necessarily fatal, and even when fatal, death may not be immediate. Occasionally children are subject to severe wounds of the abdomen by being run over by heavy teams, and here rupture of the internal organs is very common.

Rupture of the stomach may occur after the infliction of violence on the abdominal wall. As a rule, to bring about this result the stomach is more or less distended with food at the time of the wound. The stomach ruptures generally along the course of the muscular fibers, and post-mortem shows the appearance of peritonitis. This injury is generally

fatal. It may be caused by a blow with the knee, or from a fall, from severe compression, or by a kick in the abdomen.

Rupture of the intestine may be caused by a kick or by the infliction of severe contusions, by crushing between railroad cars, and similar accidents. The chief danger is from the escape of the feces (causing peritonitis) and from shock. It is generally fatal, although there is some chance of prolonging life if laparotomy is performed immediately, and the injured portion of the gut resected. The shock following such rupture is generally severe, although patients have, in certain cases, not been prostrated by it immediately.

Rupture of the liver, if at all severe, is generally fatal on account of the hemorrhage and shock. It results from violent compression, as between railroad cars or beneath the wheels of a heavily loaded wagon. Superficial tears in the capsule are not very serious and may not cause severe symptoms. Where the organ has been completely ruptured and more or less disintegrated by violence, death supervenes quickly. Very severe rupture of the liver may be caused without showing evidence externally. Punctured wounds, as gun-shot wounds, generally cause fatal hemorrhage.

Rupture of the spleen occasionally occurs from violence. It is caused by the same condition as rupture of the liver, both from violence, contusion, gun-shot wounds and punctured wounds. A diseased condition of the spleen of course predisposes that organ to rupture, even if slight violence is inflicted upon it.

Rupture of the kidney is a serious lesion. If it occurs posteriorly, cellulitis results; if anteriorly, peritonitis. Death is generally caused by shock and hemorrhage. Rupture of this organ is not as fatal necessarily as rupture of the abdominal viscera.

Rupture of the bladder may occur from external violence without leaving any evidence on the skin. It occurs when violence is inflicted upon the organ distended above the pubes. The rupture is seen as a crescentic opening near the fundus on the posterior wall. Death results from shock and peritonitis. Rupture of the bladder is rarely accompanied by ecchymosis, so that it may be difficult to determine whether the rupture has been due to violence or to spontaneous causes. The rupture due to natural causes is a very unusual occurrence. Spontaneous rupture may occur, however, when there is paralysis with lack of power to expel the urine, or when the bladder is weakened by ulceration or other disease, or where there is obstruction in the urethra. But these cases of spontaneous rupture can generally be recognized by the previous history of the patient and by the postmortem appearances. "If a man were in good health prior to being struck—if he suddenly felt intense pain, could not pass his urine afterward, and died from an attack of

peritonitis in five or six days, if, after death, the bladder was found lacerated, but this organ and the urethra were otherwise in a healthy condition, there can be no doubt that the blow was the sole cause of rupture and death. In such a case, to attribute the rupture to spontaneous and natural causes would be absurd" (Taylor).

Rupture is liable to occur only when the bladder is distended. It can hardly be regarded as an abnormal condition of the organ. An accidental fall upon a hard surface when the bladder is thus distended may cause rupture.

Wounds of the Female Genitals

The female genitals, on account of their vascularity, may be the seat of severe hemorrhage when wounded by contusion or incision or laceration. A blow on the upper part of the vulva over the pubes may cause death from hemorrhage. Wounds of these organs do not often concern the medical witness. Occasionally it is necessary to determine whether wounds of the female genitals have resulted from accident, were self-inflicted, or perpetrated with homicidal intent. Accidental wounds may resemble those produced by design, and a distinction between them is rendered difficult unless all the circumstances are known. Taylor reports the case of a girl who fell from a tree, with her legs apart, upon one of the sharp-pointed shoots below. This entered the vagina, and passing through its posterior wall broke off. The wood was removed with some difficulty and the child died in twenty-eight hours from peritonitis. Had this child been found dead with the wood in her body it would have seemed hardly accidental.

Sargent, of Worcester, reports a case which seems almost improbable from the nature of the injury and the results obtained.

"A woman, aged thirty-seven, fell upon the handle of a pitch fork which passed up into her vagina to the length of twenty-two inches. It was immediately withdrawn. The handle of the fork which was rounded at the end, was perfectly smooth, two inches in diameter, and showed a stain of blood up to twenty-two inches from the end. It was supposed that the instrument had perforated the upper end of the vagina on the left side, passed between the uterus and rectum, in front of the kidneys and behind the spleen, between the diaphragm and false ribs until it reached the muscles of the neck. Later, fracture of the first rib was noticed, which confirmed the diagnosis. The woman entirely recovered in a few weeks."

Wounds of the Male Genitals

These are often self-inflicted, and most cases occur in confirmed lunatics. Idiots and intoxicated persons may inflict upon themselves wounds

not unlike those ordinarily produced in attempts at suicide and which may bear a close resemblance to wounds of a homicidal nature.

Penetrating wounds of the abdomen are generally serious, inasmuch as they are often the cause of peritonitis. The latter condition is more to be feared than the injury to the individual organ. The following case recorded in Wharton and Stillé's "Medical Jurisprudence" is interesting as showing how recovery may take place after tremendous injury has been done to the abdominal viscera.

"A gunner and driver of the royal artillery had made a murderous attack upon his sergeant with a bayonet, whereby he inflicted two wounds, happily superficial only, upon one leg and arm. Foiled in his efforts of greater success by the seasonable arrival of some other soldiers, the culprit rushed through the barrack-square to escape his pursuers, when the sentry on duty at the gate interposed himself with his carbine, in the attitude of 'charge bayonets' to obstruct him. The consequences of this movement to the other were that as he was rushing through a narrow passage with an impetus which he could not at the time control, he threw himself (not premeditately, it will be understood) with great force upon the bayonet of the sentry, which entered his body an inch to the left of the ensiform cartilage and, passing through the abdomen, emerged by its point on the left of and close to the spinal column some inches lower down. When I reached the scene of action, some minutes after, I found the subject of this wound sitting upon a form in the guard-room, as insensible to any effects from the injury as he was unconcerned at his crime. I could not, therefore, at first believe the statements of his comrades, who told me what had happened, although the bayonet was handed to me bent by the violence to which it had been exposed; but on stripping the wounded man, I discovered the two openings of entrance and exit of the bayonet, corresponding, in form and diameter, to those which the different parts of the weapon would have occasioned. Added to this the bayonet was withdrawn from his body by a noncommissioned officer, upon whose testimony I could rely; and, what is more, this withdrawal was witnessed by a crowd of other soldiers around. Now this desperate character marched in a quarter of an hour afterward to the hospital, three-quarters of a mile distant; and at the end of a fortnight was discharged from the same, to be placed upon trial for his life. The day after his admission his urine was a little bloody; and subsequently there was a general anesthesia of the walls of the thorax and abdomen, which lasted but for a while. With these exceptions the injury was not followed by a symptom, nor did the subject require a dose of medicine for his recovery. To the circumstances of this affray having been enacted before dinner I am

disposed to attribute much of the immunity from evil which this ruffian enjoyed. Had the stomach been full, it is not easy to conceive how a bayonet could have traveled through such a track of vital organs without injuring one or more. The reader may be interested to know that the life of this soldier was spared, transportation for the rest of his days being the sentence of the court martial."

Wounds of the extremities are more important from the point of loss of function of the part than from the danger to life.

HOMICIDAL, SUICIDAL, AND ACCIDENTAL WOUNDS

It often happens that the medical witness is asked for an opinion as to whether the wounds in a given body were homicidal, suicidal, or accidental.

A dead body may be found upon which are many wounds, and it may be claimed that it was a case of homicide. The defense may claim that the man inflicted the wounds himself. The principal evidence that is applicable to such cases is derived from: (1) The situation. (2) The nature and extent. (3) The direction of the wound.

Wounds inflicted in an attempt at self-destruction are generally confined to the front or sides of the body; that is, upon those parts of the body which are most accessible. In general, they are confined to the head and neck and to the anterior portion of the trunk, especially the chest and heart. They are ordinarily made either by a cutting instrument, causing either incised or punctured wounds, or by fire-arms. A homicide, however, may select these parts with a view to creating an impression of suicide, so that the situation of the wound does not necessarily afford evidence as to whether it was homicidal, suicidal, or accidental.

Wounds on the posterior part of the body are considered by some authors to be presumptive of homicide, but here the situation is not of so much importance as the direction which may furnish evidence against the presumption of suicide. A penetrating wound from behind forward in a direct line might be attempted by a suicide, but it would involve great preparation upon his part, and there would probably also be other circumstances showing why he took such pains to simulate homicide. Although the suicide may have attempted to reach a fatal point with his weapon, whether a dagger or revolver, he may not have been successful, so that suicidal wounds are not necessarily found in the most vulnerable spots. We may say, then, that there is no wound which a suicide can inflict upon himself which may not be produced by a murderer, but the reverse is not true. There are many wounds that may be inflicted by a murderer which cannot be self-inflicted, so far as their situation is concerned.

As to the accidental nature of the wound, the situation sometimes enables us to form an opinion. This is a point often brought up by the defense in homicidal cases. Accidental wounds are generally found upon the exposed parts of the body; but on the other hand, many wounds on the exposed parts of the body, such as the face and neck, can hardly be explained by the assumption of accident, especially with deep incised or punctured wounds of the neck or gun-shot wounds of the face.

The nature and extent of a wound is often of considerable importance in affording evidence upon the question of homicide or suicide. Attempts at self-destruction are rarely made where the injury involves contusion, although a man may throw himself from a height and the fall result in contusions which are fatal. Occasionally insane or delirious people commit suicide by inflicting contused wounds upon their person in order to create a suspicion of homicide.

Taylor reports a case which occurred at Guy's Hospital, where the patient in a fit of delirium tore away the whole of the abdominal muscle from the lower and front portion of the abdomen, and says that had the body of this person been found dead with such an unusual and serious personal injury it is not improbable that it would have been pronounced homicidal and not suicidal.

The extent of the wound must always be considered in determining this question. As a rule, suicidal wounds involving the throat are not deep, nor do they involve vessels of more than one side. Yet rarely we may find suicides that have severed all of the vessels of the neck clear to the vertebral column. So that it cannot be asserted that such and such wounds are incompatible with self-destruction. Incised wounds of the throat are generally presumptive of suicide, but they may be inflicted for homicidal purposes in order to conceal the real cause of death. Irregularity in the wound together with marks of other wounds of the hands and body of the deceased generally indicate struggle before death; or, in other words, that such wounds are homicidal rather than suicidal. But the presumption that wounds that are not attended by evidence of resistance on the part of the deceased are suicidal is incorrect, for a person may have been attacked when he was asleep or intoxicated or unable to offer resistance. This also applies to those who, from age or infirmity, are unable to offer resistance. Taylor[1] mentions the case of Sellis. "The deceased was found lying on a bed . . . the edges of the incision were regular and even. This condition of the wound, it was inferred, repudiated the idea of homicide; but, as a general principle, this appears to be a fallacious criterion."

The direction of the wound is considered by some to afford presumptive evidence strong enough to enable a medical witness to express an

[1] *Loc. cit.*, p. 268.

opinion. Suicidal wounds in the region of the neck are generally inflicted in a transverse direction, from left to right, or obliquely from above downward. Punctured wounds are generally inflicted from right to left and in a downward direction. Left-handed people, of course, would reverse the direction as far as it applies to right and left. Suicidal wounds, however, are so various that it is almost impossible to make general statements in regard to them. It may happen that a wound may be in such a portion of the body that it could not be reached by the hand of the deceased, especially when it is taken into consideration that he must have held the weapon, whether dagger or fire-arm, in a given position to produce the direction of the wound. So that we may be able to say in certain cases that a particular wound is presumably homicidal rather than suicidal.

As to the other wounds, it must not be forgotten that a murderer may inflict a wound, as far as its direction and location are concerned, identical with that of a suicide; hence the medical witness must be on his guard in eliminating the homicidal element in supposed suicides. Where the wound has been inflicted in the anterior portion of the body, as has been said with right-handed suicides, the direction is from left to right; while in homicidal cases it is more apt to be from right to left. In oblique wounds of the neck homicidal wounds are more apt to be from below upward and suicidal wounds from above downward. In severe incisions of the neck, where all the vessels of the neck are severed and the weapon even divides the vertebral column, the case must be considered homicidal. A suicide may divide the vessels of the neck and may even crush the ligaments in front of the spinal column, but that they should be able to make a deep incision into the bones of the vertebral column is impossible, so far as experience goes. Evidence may often be obtained in suicidal cases from the weapon at hand or in the immediate vicinity that was used to produce the fatal wound. The edge of the weapon should correspond with the character of the edges of the incision, and the weapon should be adapted to the edges of the wound; its length may be greater than the depth of the wound, though occasionally it is less.

In general, it may be said that suicidal wounds are usually accompanied by other evidence which affords indication of the design of the deceased and which precludes the supposition of accident. This is especially true where the body has not been moved before being examined; so that the evidence of the surroundings of the body where it was found is of the utmost importance and may often lead to determining that death was accidental rather than suicidal or homicidal. Accidental wounds can generally be determined by circumstantial evidence, although they may occasionally resemble homicidal or suicidal wounds.

The charge of accident is often set up by the defense in homicidal cases, and the medical witness must always be prepared to be examined by the prisoner's counsel as to whether the wound might not have been accidental. The jury must be convinced that the wound could not have been accidental or suicidal before it will sustain a charge of murder.

The question as to whether the deceased was right- or left-handed is an important one in many cases. Often a person is considered to be right-handed when in reality he is left-handed or, maybe, ambidextrous. Many cases are on record in medical literature where the suicide was supposed to be right-handed and where, from the nature of the wound, it must have been inflicted with the left hand, if suicidal. Many of these have led to false charges of homicide, where later in the defense it was proved that the victim was left-handed. This applies to artisans, such as wood carvers, who are obliged to use both hands equally well. Some men can shave equally well with either hand, and even in a man otherwise right-handed, the finding of a razor on the left side and the cut from the right to the left would not be strong evidence that death was homicidal rather than suicidal. Often it is important to establish whether right- or left-handedness existed, or whether either hand could be used equally well, especially in cases of handling a weapon, or even in writing or other manipulations.

The presence of more than one wound upon a body has often been considered to furnish presumptive evidence of murder, but if this were followed in all cases there would be many errors. A suicide may make many attempts at self-destruction before he inflicts a fatal wound, and the same also applies to the murderer. He may inflict many wounds, though the first touched a vital spot. Suicides often make an attempt upon their lives by stabs or inflicting incised wounds upon themselves, and finishing the attempt by other means, such as the use of fire-arms or by drowning. The same may be true of murderers. After they have inflicted severe, even mortal, wounds, they may cast the living, though fatally injured, victim into the water to raise the suspicion of suicide or to make sure of accomplishing their purpose. So that, therefore, no proof as to the nature of the death, whether suicidal or homicidal, can be deduced from this kind of evidence alone, although circumstantial evidence may assist one in forming a conclusion. Suicides may even inflict more than one wound upon themselves which would prove fatal, and unless one of these wounds was immediately fatal there is no proof that they may not have been suicidal as well as homicidal. Where one of the wounds is immediately fatal or interferes with the ability to inflict another wound, such as wounds upon the head, more than one wound may, in certain cases, be evidence of the homicidal nature of the death. Where there exists more than one wound, the order in which the wounds

were received may be of considerable importance in determining the true time or cause of death.

DISTINCTION BETWEEN ANTEMORTEM AND POSTMORTEM WOUNDS

This question is often important medico-legally. Fresh wounds inflicted upon the living body show separation of the edges accompanied by active hemorrhage, the amount of the latter depending upon the size of the blood-vessels that were injured. If only capillaries are cut, the blood oozes from the wound. If an artery has been severed, this condition can be recognized by the spurting of the blood which occurs synchronously with the heart's action. But where a vein is cut the hemorrhage is not so severe, nor is there any evidence of this spurting.

The blood of a human being begins to clot in about three or four minutes after it has escaped, and it is complete in from eight to ten minutes. Where the injury is not large the blood clots within the edges of the wound so that it cannot be easily washed out. But where larger arteries are severed, the blood may spurt so freely from the wound that this clotting within the wound may be absent.

The wound tends to heal immediately. This may take place by first intention, as it is called, as seen in ordinary surgical dressings where the edges of the wound are closely apposed to each other, and where there is no inflammation or pus formed. Here the healing takes place in the course of a week or ten days, under ordinary circumstances, and there is little danger of the wound breaking open or the edges becoming separated. If, on the other hand, the wound remains open, as it will where it does not receive surgical attention, the edges gape and the wound heals by granulation. The edges of the wound are bloody for a short time, and then there follows inflammation which becomes purulent, and is succeeded by the formation of a fibrous layer around the edges of the wound, which gradually becomes harder as it encroaches upon the wound, and finally forms the scar or cicatrix. The red color of the cicatrix persists for an indefinite time, and later, after the lapse of months or years, becomes white, hard, smooth and shiny, loses its sensitiveness, and gradually decreases in size, although it never fully disappears, as mentioned under Identity (page 28).

Ecchymoses, as is well known, frequently accompany wounds. These are due to the effusion of blood under the skin in the form of extravasation. Their appearance varies according to their situation, and it may often be delayed for some time, even till after death. Such ecchymoses occurring after the infliction of a wound must be carefully differentiated from those occurring in certain diseases, such as scurvy, and the medical witness should be on his guard lest he make a wrong interpretation of the appearance.

Voluntary acts may often be performed by the victim even after he has received a mortal wound. Many such instances are recorded, but it is unnecessary to cite them as they are so common.

The process of digestion is often of assistance in furnishing evidence as to the question of wounds that are inflicted antemortem. If liquids have been ingested then they will not be found in the stomach, but if food was taken with the liquid then it will be found in some process of digestion. If a large amount has been taken it may have passed into the intestine one or two hours after ingestion, as the stomach is not completely emptied generally until four or five hours after a meal, and from the state and progress of digestion often evidence may be obtained to form an approximate idea of the time intervening between the last meal and death. The question of postmortem digestion has been much discussed, and the conclusions are so widely at variance that little reliance can be placed upon this sort of evidence.

We may say, then, that there are many things to enable us to draw conclusions from the evidence of the wound when the wound was inflicted before death, such as the hemorrhage, clotting of the blood, the gaping of the edges, the inflammation and cicatrization of the wound, the performance of acts, and the state of digestion. Any or all may be present in a given case.

Wounds made postmortem generally show appearances which are in strong contrast with those above, especially if the wound has been inflicted ten or twelve hours after death. There is but little, if any, hemorrhage, and what bleeding there is is of venous blood. The blood is dark, liquid, and does not readily coagulate. There is no staining of the wound, injection, nor extravasation into the adjacent parts, and there are no clots or coagula within the wound. There is no bleeding from the arteries as there is in the living body, and the wound does not gape, as the skin has lost its elasticity. These characteristics apply to a wound that has been made on the body several hours after death. Where the wound has been inflicted immediately after death and while the body is still warm, the distinction is not so marked, and this is the usual condition that is presented to the medical witness. For a murderer would hardly wait for rigor mortis or other changes to occur before he inflicted wounds with the intention either to arouse a supposition of suicide or to otherwise divert suspicion from himself. Here it is extremely difficult, if not impossible, to form an opinion from the appearance of the wound, and the witness should be very cautious in his statements. But to be able to say that a wound found upon a dead body was inflicted during life or immediately after death might be of material value in some cases.

What has been said in regard to incised wounds applies also to

punctured wounds, and when we come to considering contused wounds we are in very much the same position. Where the contusion occurred several days before death, there is no trouble at all in distinguishing that they were antemortem. Even if they occurred but two or three hours before death, we can generally form an opinion based upon the discoloration, swelling, and infiltration of the connective tissue and other characteristics. Further, contused wounds may be inflicted during life or immediately before death, which at first show no characteristic swelling or discoloration, but which may later, after death, show ecchymosis. Devergie remarks that this is often true of people recovered from the water, where, on account of the sodden state of the skin, the ecchymosis only appears after the water is evaporated. One cannot say that ecchymosis appearing upon a body is evidence that the victim lived for a long period after the contusion was received. It has also been proved that ecchymosis may result when blows have been administered to a dead body immediately after death, while the body is still warm. This phenomenon may be caused as late as three hours after death, and the ecchymosis be indistinguishable from one present before death. Here, too, the medical witness should avoid positive statements and should be very cautious in giving any opinion.

With lacerated and gun-shot wounds these same conditions apply. If time sufficient for nature to bring about any reparative changes has existed between the infliction of the wound and death, there are anatomical data to show it; but if the time intervening has been very short, or if the wound was inflicted immediately after death, then it is extremely difficult to form an opinion of much value.

The question of ecchymosis following necessarily after a blow is one that has already been considered, but it may not be amiss to speak of it again. It is undoubtedly true that a blow severe enough to cause death may be inflicted upon a body without showing any ecchymosis or other indication of violence on the part struck. The presence of ecchymosis is presumptive evidence of the infliction of a blow, but the opposite is not true. The absence of ecchymosis is not proof that a blow has not been inflicted. Taylor cites many cases of rupture of the internal organs that were caused by blows from without, such as kicks from a horse or being hit by a missile or the body even being run over by a wheel.

Postmortem lividity invariably appears after death while the body is still warm, but it is, of course, no indication of violence inflicted before or after death, and one should be on his guard not to confuse this lividity with the bruises inflicted before death or immediately after. If an examination is not made for a considerable time after death and putrefaction has appeared, then the difficulty of distinguishing postmortem ecchymoses from antemortem ones is still greater.

CHAPTER XII.

FRACTURES

Fractures of the bones are often important from a medico-legal point of view. They may result spontaneously or they may be caused by falls or blows.

The bones of the aged are more brittle than at any other time of life. Hence it is not uncommon for old people to fracture bones as the result of violence that would not cause serious injury in adult life. The bones of the young are not as fragile as those of the aged, but still are more fragile than the bones of adults, for it is in middle life that the bones reach their maximum solidity and firmness. Certain diseases, such as syphilis, rickets, and others, render the bones more fragile, and there is a peculiar condition in otherwise healthy people which is characterized by excessive brittleness of their bones, which appears to be more or less hereditary. This brittleness may lead to fracture from violence that would not have occurred with a normal condition of the bones. In these cases it is almost impossible to determine the amount of violence used, but at postmortem examination the assumed brittleness can be demonstrated if it really exists.

In certain cases it may be claimed that the fracture was due to spontaneous cause. Fractures have occurred as the result of moderate muscular exercise, and the parts most apt to suffer are the tip of the elbow, the knee-cap, the heel, and occasionally the upper arm, as in throwing a ball. A young lady fractured the neck of the scapula by suddenly throwing a necklace around her neck. Many cases of fracture of the thigh bone have occurred from simple muscular work where no particular violence was exerted. In fractures of this nature there is no bruising of the skin nor any appearance that violence has been inflicted. The presence, of course, of ecchymosis removes any question as to the spontaneous fracture of the bones.

Fractures of the bones are not dangerous to life except in the cases of very old people, where the shock and the subsequent treatment of putting a healthy, active person to bed causes death. They may, how-

ever, be dangerous to life when they become compound, but here the fracture of the bone is only a contributing cause, as a rule; the immediate cause being sepsis, gangrene, tetanus, etc.

Occasionally it may happen that a medical witness is asked to determine whether a fracture was produced before or after death. If the fracture occurred an appreciable time before death, there will be the effusion of blood into the tissues and other evidence of fresh laceration of the muscles, and there may even be signs of inflammation. Fractures occurring shortly before death and those occurring immediately after death, while the body is still warm, present very similar characteristics, though the degree of effusion might be less in the latter case. Fractures occurring a considerable period after death are unattended by any large amount of blood and, as a rule, offer no difficulty to the medical witness. If the person received the fracture only a short time before death there may be no appreciable evidence that he lived after the fracture or that the fracture might not have been caused after the person's death. There may be evidence of some effort of nature to repair the injury done in the way of pouring out of blood or the beginning of callus formation. In children bones unite rapidly, and late in life very slowly. Occasionally, where the person is not in good physical condition, the repair may be very much delayed, and rarely we meet with fractures that will not mend at all.

Occasionally a question arises as to whether a person has ever had a fracture. Such cases arise where people sue for damages long after an accident, claiming that they were injured and that they sustained some fracture. As a rule, in these cases the place of fracture can be made out by a slight projection or thickening of the bone where union has taken place, and often the alignment of the bones of the limbs is not normal. Sometimes the bone that is claimed to have been fractured is the bone of a limb, and in these cases the detection is more difficult. It is impossible to say in these cases how long previously the fracture took place where there is nothing but the ossified callus as evidence at our disposal. In the dead body it can be made out whether the fracture is of very recent origin or of long standing. Here a direct examination of the seat of the fracture is possible, both by general examination and microscopically, and if the bone is not completely healed there will be more or less evidence of recent fracture.

Fractures of certain bones, such as the ribs or the bones of the upper extremities, are attended with more or less pain, but do not incapacitate the person from moving about unless several ribs are broken and the chest wall badly crushed. Where the bones of the lower limbs have been fractured, generally the alignment is interfered with; but many cases are on record where the fibula has been broken and the victim

walked several miles; even the top of the femur may be fractured and locomotion be possible.

The writer is aware of one case where an insane man walked or ran some distance through the woods after he had sustained a compound fracture of both bones of the lower leg.

CHAPTER XIII.

RAPE

Rape is legally defined as the carnal knowledge of a woman by force and against her will. The law of Massachusetts is as follows:

Chapter 466. Section 1. Whoever ravishes and carnally knows a female by force and against her will shall be punished by imprisonment in the State prison for life, or for any term of years.

Section 2. Whoever unlawfully and carnally knows and abuses a female child under the age of sixteen years shall be punished by imprisonment in the State prison for life, or for any term of years, or for any term in any other penal institution in the Commonwealth.

Another statute defines the crime as follows: "The unlawful forcible carnal knowledge by a man of a woman against her will and without her consent; or the carnal knowledge by a man of a female child under the statutory age of consent."

This legal definition of rape immediately brings up the question of what is "carnal knowledge"? Formerly, in order to substantiate a charge of rape, proof of both penetration of the male organ and the emission of semen was required. The law at present is that proof of penetration only is required, the fact of the emission of semen being immaterial. It has been held (in England) that to constitute a rape penetration, even without effecting rupture of the hymen, is all that need be proved; the degree of penetration is immaterial.

By carnal knowledge, therefore, is meant any degree of sexual intercourse. The expression "partial penetration" is not recognized by law. In other words, if the victim can show that the assailant entered her person at all, however slightly, it is sufficient to prove the charge. And this is the general rule, applicable in most States, especially in reference to children under the age of consent, which is generally fourteen years of age. If the girl is under the legal age, her consent is invalid; and knowledge of her person, with or without her consent, is, in both cases, rape.

Defloration should be distinguished carefully from rape. Defloration may be defined as the effect of the first intercourse, and may result

whether the act is performed legally or with criminal intent. It may occur in rape, but not necessarily so.

The term "by force", which is used in the above legal definition, implies force that is necessary to overcome the will of the victim. This force may be physical or moral. The law makes no distinction. There are many instances where the crime has been committed in which the woman was incapable of showing that her consent was withheld. The ravisher may threaten by word or action, so that the victim makes no resistance, and here the crime is unlawful. The victim may be under the influence of narcotics or in some physical condition, as in hysteria or hypnotism, and unable to express her refusal; and in these cases it must be held that the crime was committed "by force". The resistance that the victim is required to show is the utmost resistance that she is capable of, this depending, of course, to a certain extent, not only upon her physical vigor, but also upon her mental condition. Sometimes a strong, muscular woman may be so frightened that she cannot exert her usual resistance.

The age of the victim has an important bearing upon this question of consent. In Massachusetts the "age of consent", as it is called, is fixed by law as sixteen. In many other States of the Union it is fixed as fourteen; in others it is even less. In Alabama it is ten; Louisiana and Texas, twelve; in Iowa, thirteen, and in New York and Pennsylvania, sixteen.

Children under sixteen are supposed to be lacking in an understanding of the crime and not to have the discretion which gives or withholds the consent. Here, also, the element of force is not taken into account. It is sufficient to show that the crime has been attempted.

Intercourse with idiotic or insane women is deemed to be rape, as such women are considered incapable of distinguishing between right and wrong. Further, a woman above the age of consent, who, for any cause, can prove that she was ignorant of the nature of the crime when she submitted to the act, can bring a charge of rape.

The essential point in rape is the physical force that is employed to accomplish the unlawful purpose; that is, rape may be committed on a common prostitute or by a man on his mistress or even on his wife; the point being that physical violence in such cases must be clearly proved. The character and reputation of the complainant is considered no bar to the prosecution. In these latter cases the proof must be conclusive, and in these generally some anatomical evidence of traumatism must be obtained to corroborate the woman's claim.

Delay in entering a complaint against a person on account of the crime of rape is no bar to the prosecution, although it may make conviction more difficult. The old Scottish law that required a woman

to enter her complaint within twenty-four hours does not hold, but a long postponement of a medical examination and delay in informing relatives and intimates of the alleged assault is a serious drawback to conviction. The medical examination should be made early, as the physical appearances resulting from an attempt may disappear; and it may well be said that the longer the delay in entering the complaint or in submitting to medical examination, the greater is the suspicion that the claim is false. Formerly, a woman's testimony was sufficient to convict, but partly due to the number of cases of false accusation, corroboration of the woman's testimony is sought for. A woman may easily set up a charge of rape against a man when she has willingly consented, and the difficulty in disproving such an accusation requires confirmatory evidence on the part of the complainant.

We may treat the subject of rape under three headings: cases perpetrated upon young girls under the age of consent; those perpetrated after the age of consent, and rape upon adult women who are accustomed to sexual intercourse.

The majority of the victims of rape are young girls, too young to offer resistance or to understand the character of the violence to which they are submitted. There are several reasons for this condition, the chief of which are the ease with which a man may commit an assault on account of the immaturity and lack of physical development of the girl, and the abhorrent belief entertained by the ignorant that a man suffering from gonorrhea will be cured if he has intercourse with a chaste virgin. Young girls are often the victims, as they are less likely to offer resistance. Some authors assert that this disgusting custom is quite prevalent, and often advised by old female practitioners.

Brouardel says: "People unfamiliar with medico-legal practice have an idea that a rape or an attempt at rape is a struggle in which a young man, in full vigor, amorous, excited, brutal, endeavors by violence to obtain the favors of an attractive young woman, who succumbs to him only after energetic resistance. All the details in this picture are false or only exceptionally true. The reality is much sadder, if possible. Most often the guilty party is an individual having some authority over the victim by right of relationship or neighborhood. Frequently, the assailant is one weakened by old age or intemperance, not one excited by lust or by sexual passion. The victim is a little girl, defenseless, generally a mere child with stunted intellect, bred in poverty, one upon whom it is easier to distinguish the disorders and effects resulting from repeated acts to which she has habitually consented, rather than traces of a single brutal assault leaving the evidences of the violence used."

There is wide variation in the physical effects and objective proof of force perpetrated upon young girls, varying from the most superficial

and temporary lesions to serious and even fatal injuries. This is easily accounted for by the amount of violence used and the degree of resistance on the part of the victim, and the inequality in the vigor of the assailant and the assaulted. In young girls the sexual organs are so little developed that intercourse cannot be accomplished without producing extensive injury; and complete intercourse has often been obtained, resulting in very severe lesions. There are several such instances recorded in medical literature.

Taylor gives the following instance:[1] "A female infant of eleven months was with her mother, who was among some camp-followers. A soldier on the march took the child to carry it. The child was well when he took her. He walked on quickly and was out of the mother's sight in half an hour. When she came up he had the child standing on the ground facing him and he was bent over it; one hand held the petticoats up and the other was covered with blood. He told the mother that the child was ill and passing blood. Next morning, on washing the baby, marks of violence to the genitals were seen, and a surgeon, who was called in, found the child in collapse; it died in a few hours. On examination, all the external parts were found to be torn and inflamed; the perineum was torn nearly through; the nymphæ and the mucous lining of the labia were lacerated; the whole presenting the external appearance of a large wound. The vagina was greatly dilated and torn from its attachment to the neck of the uterus posteriorly, making a large rent in the abdominal cavity in which a quantity of bloody serum was effused. Of this case Hofmann says: 'One cannot admit that these lesions were produced by the penis; they appear rather to have been the result of brutal manipulations made with the hand; favoring this hypothesis is the fact that the mother found the soldier's hand bloody when she reached the spot where her baby was'."

Dr. Fort reports the following case, where the perpetrator of the crime was burned at the stake by the infuriated citizens of the town:

"A little flaxen-haired girl, aged three years eight months and five days, was picked up at her father's gate about nightfall by a tall, lean, raw-boned negro, about thirty years of age, and about one hundred and seventy-five pounds in weight. The negro carried the child to a secluded wood on the outskirts of the city, and there, night after night, perpetrated a crime unheard of in the annals of history. The question as to how he accomplished the act was asked the negro, and he answered, 'I smothered the child's cries by putting my hand over her mouth. I then tore the parts and made them large enough to force an entrance.' The child was outrageously torn and mutilated. The examining physicians report complete laceration of the perineal body, the rupture

[1] Draper, *loc. cit.*

connecting the vagina and abdominal cavity, so that the penis of the negro must have passed immediately into the abdominal cavity. It was not learned, as the brutal negro did not seem to know, at what stage of this torture the child died. The child was choked until its tongue lolled from its mouth, and remained so. The bruises from the grasp on its throat were plainly defined."

Such cases are so shocking that the utmost penalty of the law is none too severe for the perpetrator. Cases vary from extremes as just cited to those where there is merely penetration of the vulva and where the effects, even on the internal organs, may be wholly negative. Where evidence is lacking in such cases it must not be lost sight of that they are not inconsistent with other evidence tending to prove the charge. In these latter cases, however, another fact must not be lost sight of, namely, that many unscrupulous mothers enter fraudulent charges of rape for the purpose of blackmail or spite. Therefore, the physician, when called to examine such a case, should be on his guard that he does not become a party to the prosecution of an innocent man or assist in the discharge of one whose intention was none less wicked because traumatism is lacking. Many cases of such fraudulent charge are recognized by writers in legal medicine. In fact, mothers or other kindred have gone to the extent of actually injuring the child's genitals to simulate the appearance of rape in order to bring a charge against a man either for blackmail or revenge.

One case is reported where a child ultimately confessed that the condition resulted from the parts being rubbed with a blacking brush. The nymphæ were congested and edematous, and all the parts were inflamed and covered with a thick, greenish pus.

Another instance is related by Casper: "A tradesman of irreproachable character was accused by a woman of having violated her daughter, a child of eleven years, and having given her gonorrhea. The child was scrofulous. Her clitoris was unusually developed and the entrance to the vagina was inflamed and painful to the touch; the hymen was obviously stretched and there was a copious discharge. On examination the defendant was found to be free from disease, and on cross-examination it was brought out that the mother, after fruitlessly endeavoring to extort money from the tradesman, had delivered her child to her own paramour whom she knew, from her own condition, to be affected with gonorrhea."

Signs of Rape.—The signs exhibited by young girls are usually different from those exhibited by adults. The inspection of the external genitals, if the examination is made soon after the assault, shows a swollen, red, hot and tender vulva, with ecchymoses, excoriation, and possibly erosions of the mucous membrane of the labia majora. The

ostium vaginæ especially is inflamed. Examination is difficult, as there is tenderness, and it may be necessary to use ether or cocain as a local anesthetic. The gait is suggestive, as it approaches a waddle. These symptoms are more marked where there is ulceration produced accompanied perhaps by sloughing. Finally, a purulent or mucopurulent discharge from the genitals appears, called by Tardieu the "capital sign". It is greenish yellow in color and abundant. It appears on the second or third day and is accompanied by severe itching or smarting. It simulates in color and consistence the usual discharge in the initial stage of gonorrhea, and is easily mistaken for this. According to Casper, this discharge is almost always found in children from twelve to fourteen years of age, when the genital organs have been roughly abused from any cause. It is extremely important, although the law does not differentiate as to the nature of this discharge, that a physician called in to such a case should be able to diagnose between a case of vulvitis or vaginitis which might follow an attempt at criminal intercourse or not.

Many young girls have vaginitis which might easily be mistaken for gonorrhea or as the result of violence, but which is not in any way attributable to these causes; and this is of particular importance in those cases where false charges are brought. On the other hand, gonorrhea is strong evidence that the young girl was assaulted by a man infected with the disease, but it must not be lost sight of that she might have acquired her condition by accident. The true gonorrheal discharge does not generally come on until the fourth to eighth day; it is usually much more profuse than the discharge which is due to violence from rape or to infantile leukorrhea. The gonorrheal discharge lasts longer, while the discharge due to violence generally ceases by the tenth or twelfth day.

It should be borne in mind that the hymen is sometimes absent in young children, due either to congenital cause or to its destruction by septic processes to which weakly and ill-nourished children are prone, so that mere absence of the hymen is not proof of the perpetration of rape, unless accompanied by signs of violence on the genital organs. Severe injuries may be produced by the male organ. McKinlay reports a case of extensive injury inflicted on a girl six years old. The vagina was ruptured in various directions; one laceration dividing the recto-vaginal septum and perineum down to the edge of the anus. There was a lacerated opening in the coats of the rectum, and the genitals were generally red and swollen. Recovery from these injuries took two months.

Occasionally, owing to the violence used, laceration of the external genitals is followed by sloughing, but the latter condition may even be caused without actual laceration of the parts. Death may be caused by injuries inflicted on the genital organs, especially when brutal attempts

are made to effect penetration. Fatal results may be due to hemorrhage, shock, or to the extension of the injury into the bladder, rectum, or peritoneal cavity.

There are certain late manifestations in the form of ulcerative processes about the vulva which may be of value as secondary evidence in a diagnosis of rape. There may be indurated chancre, soft chancre (chancroid), ulcerations due to the vulvitis, whether idiopathic, traumatic or gonorrheal, and herpes accompanied with ulceration. Indurated chancres present sufficient characteristics to recognize their nature. Absence of induration and of nonsuppurative glandular infection generally indicates infection other than by syphilis. Hofmann, speaking of chancroids, says: "It is often very difficult to distinguish the soft chancre from other ulcerations, particularly the traumatic sort." The chief distinction is in the progress of the ulceration. Chancroids extend rapidly; ulcerations and traumatism are generally limited to the original inflammation, and heal much more rapidly than specific lesions. Chancroids may be produced by inoculation, but other ulcers cause small local inflammation, and never exhibit the results which characterize chancroidal pus. The location of the ulcer is no guide. Chancroids occasionally are found on the labia majora at the ŏstium vaginæ, but traumatic or catarrhal lesions may be seen in the same place.

There is a rare condition known as "noma pudendi" which may cause error in diagnosis. It is an unhealthy septic inflammation about the external genitals, soon producing necrosis, and generally proves fatal. It is not accompanied by any discharge, and may be differentiated from traumatic idiopathic vulvitis. It is generally endemic, but ignorance concerning it may lead parents to suspect that a criminal act has been perpetrated upon the child. The disease begins with a grayish or blackish vesicle which ulcerates and sinks below the surrounding tissue. The gangrene covers the labia, and is accompanied by a fetid, greenish, serous discharge.

RAPE ON VIRGINS

In considering the question of rape on virgins, other points than those mentioned in rape on young children must be brought into consideration. Here the question of consent is of great importance, and whether the intercourse, granting that one took place, occurred for the first time and whether it was at the time alleged.

The "age of consent" and "against her will" are questions that have already been considered, and what has been said in regard to violence or force applied to uphold the contention of the victim in a given complaint of rape applies here also.

We will first take up the consideration of the virginity of the victim.

These signs are fairly well established, although there are certain discrepancies and many facts which may not permit of a positive opinion.

Duchatelet says that the external genitals of prostitutes do not present any absolute uniform differences or appearances to distinguish them from those observed in married or chaste women. Many young girls engaged in prostitution have vaginæ as large as those who have borne children; but on the other hand, many women who have followed this calling for many years and show signs of premature age have vaginæ and other parts which present nothing noteworthy.

Among the signs of virginity, but of less importance than others, we may mention the breasts which are undeveloped in their relation to the rest of the body; their texture is firm; they are conical in shape, and the areola around the nipple is narrow and without pigmentation; the nipple itself is small.

In regard to the genitals, the labia majora are firm, symmetrical, in close apposition, and cover the urinary meatus and the deeper parts.

The labia minora are relatively small and concealed within the external labia. They are smooth and delicate, unwrinkled, with a pinkish color which differs from the yellow found in other conditions.

The clitoris does not afford much valuable evidence. A small, undeveloped clitoris may presuppose virginity, but the reverse is still less valuable evidence.

The fourchette forms a sharply defined limit at the posterior part of the vulva, which is rarely destroyed by intercourse, but frequently by child-birth.

The vagina of virgins is narrow, and its tissues are smooth and soft.

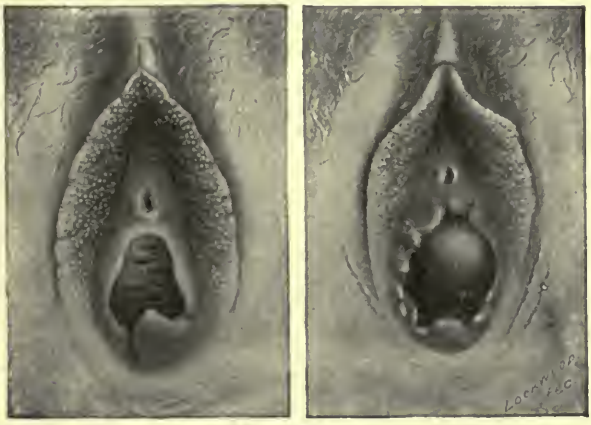
These conditions are presumptive indications of virginity, but their value is relative only at the best. Prostitutes may show them all. Accident, disease, gynecological examinations, or other causes may obliterate them all, even in chaste virgins.

The hymen is the chief evidence of virginity, but even this has given rise to much controversy, and it is not invaluable evidence on one side or the other. It may occasionally be lacking from congenital or other cause, and it may even persist after child-birth; but most authorities are agreed that it is generally present in a chaste virgin. Some authors even allege that its supposed absence is owing to faulty examination, and that it is always present in virgins.

In shape it is annular, with a central opening. Usually though the orifice is not in the center, and anterior rather than posterior, so that the appearance instead of being ring-shaped is crescentic. It appears as a curtain, or thin layer of tissue across the posterior or lower portion of the entrance to the vagina, inserted laterally into the labia minora. Various modifications of these two types, the annular and the crescentic,

are seen. The opening may be very small, scarcely admitting a probe, or it may be larger, admitting the finger, or even allowing intercourse without injury.

Tardieu describes five varieties as a result of his examination of over six hundred subjects. These he places in the following order of occurrence: (1) A form consisting of two lateral lips approaching each other in the vertical line. This is the shape most commonly found in children and occasionally after puberty. (2) An irregular circular diaphragm, with a more or less small opening in the anterior third (hymen annularis). (3) The diaphragm is circular with a central round opening (hymen circularis). (4) The hymen is crescentic, with a concave border projecting forward and two horns ending on the inner side



a. *b.*

FIG. 6.—VARIETIES OF HYMEN.
a. Normal injury at coitus. *b*. Carunculæ myrtiformes.

of the labia minora (hymen semilunaris). (5) The hymen has a low, circular or semilunar edge, which is often overlooked and mistaken for its entire absence.

Other forms are occasionally met with, such as the double hymen, the cribriform and imperforate hymen, the hymen with the serrated edge, the fimbriated hymen, the hymen which simulates defloration and the tongue-shaped hymen of Lutan.

The hymen varies further in its thickness and toughness. It may be transparent, or it may be dense, fibrous, or tendinous, the latter requiring surgical operation.

With the patient in an upright normal position the hymen is folded upon itself, adapting itself to the entrance to the vagina, and is not tightly stretched. Formerly, it was considered that the hymen was a part of the vagina, and that it was developed along with the other organs

coming from Müller's ducts, but the entire absence of the uterus and vagina have been known to occur with a well-formed hymen, and the absence of muscular fibers from the hymen tends to cast doubt upon this origin. Other authors claim that it is developed from the urogenital sinus from below upward.

The presence of an entire, uninjured hymen without cicatrices is presumptive proof of virginity. This presumption is wholly in favor of the woman because the first sexual intercourse usually tears and ruptures it, and thus leaves marks of its injury. But the reverse can generally also be held; that is, that the absence of an intact hymen or the appearance only of remnants indicates that the woman is not a virgin, and that the hymen was destroyed by sexual intercourse. Both of these conclusions, however, should be made with some reservations. The hymen may be lost or injured by other than any sexual violence, and, as Duchatelet has said, prostitutes may retain these signs of virginity.

On the other hand, there are many cases on record where pregnancy has advanced to maturity, in which the hymen remained intact even up to the time of labor. These generally are tough, resistant hymens that have withstood the ordinary force of intercourse. Ogston records a case where the hymen was persistent, leaving only a few small openings in it. It was strong and dense and had withstood all attempts at intercourse. The woman became sick, her abdomen enlarged, and dropsy supervened. She went away for treatment, but did not improve, and on her return she was suddenly seized with pain which she supposed to be colic. The pains became so severe that she was obliged to interrupt her journey, and in a short while gave birth to a living child.

Such cases are exceptions to the general rule and do not retract from the value of the hymen as a sign of virginity. It is a sign on which most reliance is placed, and these few exceptions do not lessen its value in the great majority of cases.

Defloration.—As already mentioned, defloration is the result of the first intercourse on the ostium vaginæ. It occurs when the act is freely done, as well as when it is perpetrated by violence, so that it of itself does not in any way prove rape. On the other hand, it may not eliminate rape, although rape may be perpetrated without defloration. An examination for defloration should be made as soon as possible, as the physical signs are more or less transitory, and may disappear in three or four days. These signs vary according to many conditions: There may be a wide disproportion between the penis of the adult man and the genitals of the woman. The age, vigor, strength, and determination of the man give him a decided advantage over the woman.

The signs of defloration that are usually seen are: (1) Bruising of the clitoris and labia. (2) Swelling of the vulva, with heat, tender-

ness and pain in the parts. (3) Excoriation of the clitoris and labia minora. (4) Occasional laceration of the vulval mucous membrane, with ecchymosis under the mucous membrane of the labia. In these cases there is pain to the subject on attempting to separate the thighs to examine the vulva. Further there may be excoriation of the vaginal mucous membrane, accompanied by a viscid, mucous discharge. Discharges of a gonorrheal nature, or noninfectious, as the case may be, and finally, a ruptured hymen. The latter, if it occurs, is, of course, a "capital sign", and if associated with these other symptoms its value is much increased. It does not always occur as the result of intercourse, but it is of sufficient frequency to establish the rule. The laceration generally extends from before backward, and consists of a single tear. Rarely there is a double tear, and occasionally severe lacerations result, and there may be three or more rents. The varieties of the injury are determined by their form; the resistance and extent of the hymen; and whether or not vaginal folds reenforce it behind; and, to a certain extent, the degree of violence exerted. The fourchette may be included and even the perineum.

A recently ruptured hymen exhibits the characteristics of a lacerated or contused wound. Its edges are red and blood-stained, and this is accompanied by swelling and tenderness. The parts become inflamed and suppuration may follow, so that it delays healing. Ordinarily, the tear is healed in three or four days, but it may be a week or ten days before the lesion is recovered from if the victim is in poor health or if extreme violence was used. Of course, where there is inoculation with syphilis the recovery is much slower.

There has been much discussion by various medico-legal authorities as to the healing of a ruptured hymen. Some maintain that it unites so that the membrane is restored; others claim that this is possible, but improbable; while still others maintain that it not only occurs, but that it can be demonstrated in certain cases. To do this, it is necessary to stretch the hymen to obliterate the natural folds in order to perceive the linear scar. These signs and conditions just mentioned are those of defloration only. They are the usual ones to occur as the result of the first intercourse where the woman has given her consent. They do not enable one to declare that they are the result of sexual intercourse or violence. Further, they may not even be the result of sexual intercourse at all, for they may be accidental or intentional. Examinations carelessly made by the gynecologist; the introduction of specula or of pessaries, or even of the finger; the falling astride of a chair or fence, rough riding on horse-back, falls, and even forcible separation of the thighs. All these and others may cause accidental rupture of the hymen and have nothing to do with sexual intercourse.

There is one kind of evidence, however, which, if it is present, is proof positive of attempted rape, and that is the detection of seminal stains upon the person or clothing, or even in the neighborhood of the victim at the time of the alleged assault. Such evidence is valuable medical evidence, but it is not required by the law in order to convict of rape.

There are many causes which may lead to the failure to detect spermatozoa even in undoubted seminal stains. The semen may be so diluted with blood from the woman's torn parts or with the vaginal discharge that they cannot be detected. Further, the semen even from vigorous young men does not always contain spermatozoa, and in old men their absence is not uncommon.

Occasionally in charges of alleged rape the examination may be somewhat embarrassed by finding blood upon the genitals and adjacent clothing of the victim that has been intentionally put there in order to maintain a false charge, or the blood may be present as the result of the menstrual flow and be mistaken for blood as the result of injury. One should be on his guard in such cases in order not to be led to be a party to a fraudulent charge.

So far, we have confined ourselves to the examination of the physical signs about the genitals, and to the detection of seminal stains, but these may be nothing more than what might be found as the result of a lawful intercourse. To sustain the charge of rape, it must be shown that the victim did not consent to the act, or that she resisted and her resistance was overcome by physical or moral force. The evidence of such physical force is to be sought for in other parts of the woman's body. If she can show bruises and excoriations upon her body that are probably not self-inflicted and which can be explained as the result of the struggle, then this evidence taken in conjunction with the signs of defloration, and in certain cases the presence of seminal stains, may justify the medical jurist in forming an opinion which corroborates the charge of the victim. Injuries are most likely to be found on the neck, thighs, groins, knees, forearms, wrists, and occasionally upon the breasts.

Most, if not all of this evidence may occasionally be lacking. A woman may be seized and bound to prevent her struggling, or she may be overcome by fright, or she may be powerless as the result of the administration of drugs; she may have been hypnotized, or there may have been several parties to the assault, so that she could not offer any resistance. So that it occasionally happens that a medical expert's opinion cannot go further than to say that he found nothing in his physical examination to substantiate the charge of rape; but he cannot, when such evidence is lacking, say that rape was not committed. In order to form a positive opinion he should establish the presence of all

or most of these various signs; that is, not only the presence of seminal stains, but also the marks of violence, such as bruises, etc., upon the victim's body.

Defloration in conjunction with these other signs is strong evidence, but it may be lacking, and the law does not require it in order to convict of the crime of rape. The proof of assault upon the woman is the essential point, and in some instances the presence of bruises and contusions is all that can be shown. In these cases the medical jurist can only declare that they are not inconsistent with the complainant's charge, but that they do not necessarily prove it.

There are certain conditions that in special cases may be confirmatory evidence. A woman may charge that she was assaulted, and in proof of this charge may exhibit a gonorrhea or signs of syphilis. Such proof, to be of value,should be accompanied by further proof that she was free from such disease before the time of the alleged assault, and further, that the interval between the time of the assault and the appearance of the disease is consistent with the time of incubation for the disease, and that the assailant was suffering from such disease at the time of the alleged assault. Such cases must, of course, be extremely rare.

The medical expert should be conservative in expressing an opinion as to the nature of the vaginal discharge in any given case. It may be idiopathic, as we have seen with young girls, or it may occur in adults as the result of many causes. Many of these discharges have a close resemblance to the gonorrheal discharge, but assistance can often be obtained by a bacteriological examination.

RAPE OF MARRIED WOMEN

Here, although the age of consent may play a part, we have, on the other hand, the loss of much valuable evidence, namely, presumably the woman has had sexual intercourse, and she may even have had childbirth. Here, of course, the signs of defloration are usually lacking. In fact, the medical evidence of rape may be entirely wanting, and, as the crime is often attempted without accomplices, the statement of the woman is the chief evidence against a man. Such cases must always be carefully investigated, as cases of alleged rape are not uncommon.

Of course, in certain cases of rape of married women we may have sufficient evidence to sustain the charge. Here too, there may be a wide disproportion between the size of the male organ and the female genitals; or if great force or violence attended the assault, we might expect the evidence of local injury; but the absence of these injuries does not permit the medical expert to say that rape has not been attempted, for cases are recorded where rape has been accomplished by accomplices holding the woman, and there resulted no medical evidence of any kind.

The evidence of local injury, bruises and excoriations are of great importance in alleged rape of married women, as they show resistance on the part of the woman, and violence and determination on the part of the man. Some medical jurists claim that rape cannot be perpetrated on adult women of good health and vigor, and Taylor[1] says: "It does not appear probable that intercourse could be accomplished against the consent of a healthy adult, except under the following conditions: 1. When the state of unconsciousness arises from natural infirmity, as in idiocy and imbecility, carnal intercourse with a woman is regarded as rape. 2. When narcotics or intoxicating liquids have been administered to her, either by the prisoner or by his collusion, provided the intent be to stupefy or overpower her, with the intention of having intercourse with the woman."

The lesions are similar to those found in virgins, that is, marks on the neck, groins, knees, wrists, and breasts, always bearing in mind, however, that the injuries might be self-inflicted in order to help sustain the false charge of alleged rape. The occurrence of gonorrhea or syphilis is of equal value as evidence in cases of rape of married women as upon adult women or virgins.

If the woman who charges that rape has been perpetrated upon her is a prostitute the medical evidence must be strong and convincing, and her statements must be taken with a certain amount of reserve. It must be shown that extraordinary force and violence was used, and this evidence will be probably accompanied by local signs to show that the intercourse was without consent.

We see, therefore, that it is much more difficult for the medical expert to express a positive opinion corroborating the woman's story, where the complainant is a married woman, the field of evidence being so constricted, and, in certain cases, as already mentioned, there may be no evidence of violence at all. In cases of virgins, we have the evidence of defloration, the broken hymen; and in case of children the great physical injury due to the greatly disproportionate parts. In all three classes we may have various confirmatory evidence, such as the presence of seminal stains, etc., and in rare instances the infection by gonorrhea or syphilis.

Intercourse with women who are ignorant or weak-minded is rape, although no resistance is offered.

There is a question whether a man can have intercourse with a woman without her knowledge, while in a state of unconsciousness from unnatural sleep. Casper mentions such a case of a girl of sixteen years of age who accused a man of having had intercourse with her while she was asleep in bed. She maintained that she was a virgin up to the time, and Casper concluded that if her statement was true a man could not

[1] *Loc. cit.*

have had intercourse with her without causing pain and arousing her to consciousness. The bare possibility of the offense being perpetrated under these circumstances cannot be denied, but this admission can apply only to those cases where women are accustomed to sexual intercourse, or where the sleep is very deep and lethargic.

Another case reported by Taylor of the respectable wife of an innkeeper, who had borne children, threw herself on her bed, dressed, late at night and fell asleep. She was awakened by finding a man upon her body in the act of withdrawing from her. There was no reason to believe that the complainant was aware of the assault until the crime was completed, and she was awakened by the weight of the prisoner's body. A conviction was obtained.

The condition of unnatural or hypnotic sleep has given rise to the question whether rape could be perpetrated or not, and in regard to this Luff says: "While admitting the hypothetical possibility of the violation of a woman or girl of a certain neurotic type while in a condition of so-called hypnotic sleep, such accounts must be regarded as very suspicious and rather as specious excuses for nonresistance than as trustworthy statements.

"A girl of eighteen consulted a therapeutic hypnotizer as to her health. She visited him daily for some days. Four months and a half afterward she discovered she was pregnant, and complained to the authorities against the man. They directed a determination of the date of her pregnancy to be made by a physician and surgeon, and secondly, whether the complainant might have been violated and rendered pregnant against her will. The medical inspector was satisfied that the pregnancy did not extend farther back than four and a half months; and they concluded that as a person in magnetic sleep is insensible to every kind of torture, sexual intercourse might have taken place without participation of her will, that is, without her consciousness."

A woman may be under the effects of an anesthetic and experience a sensation of intercourse, and subsequently lay a false charge against the dentist or doctor of alleged rape. These women are often honest in their belief, but labor under the delusion as a result of the anesthetic. Such a case is the following:[1]

"A young lady of unimpeachable character, who has for some time been engaged to be married, is accompanied by her betrothed to the house of an eminent and highly respectable dentist, who had been engaged to plug one of her teeth. They arrive at about ten o'clock on a Friday morning. She enters the house, and after a few minutes spent in awaiting the exit of two other ladies, she is ushered into the operating room or office. Here we will allow her to continue in her own words.

[1] Wharton and Stillé. *Loc. cit.*

"'I went into the office, took off my bonnet, and Dr. B— went to his washstand to wash his hands, and asked me after the family; I took a seat on the operating-chair; in a few minutes Dr. B— told me that one of the men wanted to speak to him, and he gave me a book to read and left the room; did not say what man; I supposed that there were men there; he has a room in which the teeth are made; I believe those to be the men; Dr. B—'s family were out of town at the time; he said so, and the door was opened, and there was no furniture in the front room; I don't know how long Dr. B— was absent; when he came back I was sitting in the operating-chair; he went to the instrument case and began with my tooth; the tooth was on the left side; he commenced operating on the tooth before he gave me ether; the operation was very painful; he said he would either put something in to destroy the nerve or give me ether, leaving the choice to me; I told him I'd prefer taking ether; I didn't learn what he proposed putting into the tooth; he gave me the ether on a small napkin folded up; I felt very dizzy at first; I was cold and felt very numb; it increased upon me; I did not lose my consciousness of what was doing; I continued to breathe the ether; my eyes were closed; I closed them voluntarily; I did not try to open them for some time after; after he gave me the ether, he did not, as I remember, operate on my tooth; he felt my pulse several times; put his hand on my arm under my sleeve, up my arm; I had a loose sleeve; he did it once; he put his hand on my breast under my dress; on the bosom; he put his hand on my person, under my dress; I have a distinct memory of that; I was not able to make any resistance or outcry; he went round before me and raised my clothes: I am perfectly distinct in my memory of that; I did not try to cry out; do not know if I was able; after he had raised my clothes, my feet were crossed, and he raised them and put one on each side of the stool; he then put his arm around me under my clothes; he drew me down to the edge of the chair; I do not know what he did after that till I felt pain; he did enter my person; it was then that I felt the pain; I was not able to cry out or resist; I did not try; I don't know what was his position; my eyes were closed; I have no doubt that he did enter my person, and did give me pain; all this time I was conscious of everything that was going on; after this he left me and crossed the room to the washstand; I heard him pour out water into the basin; after he had been to the washstand and returned, I opened my eyes and saw my clothes up; he did not see me; I have a clear recollection of seeing my clothes up; I closed my eyes immediately; he put down my clothes, and in a few minutes he was at the side of the chair, and lifted me upon the seat; I was just to the edge of the seat; it was a large dentist chair; in a few minutes he told me he'd have to take the tooth out; that was the first remark he

made, except the first, when he asked me if I was getting sleepy; at the time he entered my person I did not feel his person against me; pain I distinctly felt; when he spoke about taking out the tooth, I asked him why; he said they were both decayed and he could not save them both; I told him I was afraid it would pain me, and he said he would not let it; he then gave me more ether and extracted the tooth; it was on the left side; when he extracted the tooth it was painful; I screamed then; he then assisted me to rise, and led me to the rocking chair; he then went out of the room, and in a few minutes came up with a lady; I have not seen her since; he asked me if I would be introduced to her; I believe I said no; he did not introduce me then; I heard him tell the lady he'd always been our dentist, and that we never had been to any other; he said my teeth were very good; he said I had taken ether when the tooth was extracted; I think she said something about hearing me scream; he said yes, ether had not much effect on me, I was either nervous or for some cause; in a little while I got up and he introduced me to the lady; I think it was Mrs. P—; I made several remarks, but I don't know what they were; I then put on my bonnet, and Dr. B— followed me downstairs; the lady was left upstairs; he came to the door, and I wanted to stop an omnibus; he asked me how far I was going, and I told him to Third Street and Lombard; he told me I had better walk; he said he thought I had some of the ether in me, and the walking would do me good; I walked down Walnut to Sixth, and did not get into an omnibus; I did not reproach Dr. B— at the house; I was afraid; I stopped in C—'s ice-cream saloon, at Sixth below Prune; I got ice-cream; I went then along Sixth Street to Spruce, and down to Third and Lombard Street; I was going to see a young woman that sent for me; I did see her; don't recollect how long I was there; when I left I came up to Mr. T—'s at Chestnut street, near Fifth; I was very intimate with Mr. and Mrs. T—; I met Mr. M— on the way up, near Sixth and Chestnut Street; he joined me and spoke to me; did not accompany me to Mr. T—'s; did not meet any but those I have named; I reached Mrs. T—'s at about one o'clock; they had not been to dinner; I first mentioned to Mrs. T— what had occurred at Dr. B—'s the same day after tea; that afternoon I was taken unwell; it was the usual time; the door of the dentistry-room at Dr. B—'s was shut; there are two doors in the room; the one leading to the entry door was closed; Dr. B— said that he closed the door because the smell of ether would go over the house; the door was shut before he gave me the ether; the chair is one that leans backward.'

"*Cross-examined.*—'Dr. B— was the dentist of our family; don't remember the number of years; it was from the time of my early youth; he attended all the members of the family so far as they required; I went to him with the approval of my parents; he generally behaved like a gen-

tleman; I did not know his family; don't know how many years I have been his patient; when I called with Miss Thr—it was to get my tooth plugged; on several times before I had taken ether; I requested it to be given; I don't remember of his persuading me from it; the tooth was not plugged when I was there with Miss Thr—; the following Thursday was appointed for future operation; I did not go on Thursday; Mr. Thr— had the appointment made; I believe it was on Wednesday morning; I received a letter from him to that effect; I requested him to go in with me; he was there when the woman came to the door; I was shown into the front parlor; it was the usual place; it was but a few minutes before the ladies came down; Mr. B—came down before; he said he had several young ladies up stairs and would be down in a few minutes; I went into the usual operating-room upstairs; the door opening into the front room was opened at the time; it was the back room of the main building I was in; the workshop is in the second story back building; don't know how far from the room in which I was; it is not upon the same level; it is lower; I don't know if I could see into the windows of the workshop from the window of the room in which I sat; when Mr. B— went to see the workmen he gave me one of the monthly magazines; while I was in the room nobody came to the door that I saw or heard; don't know of the doctor leaving that room; did not see any women there except Mrs. P— and the Misses H—; the windows were closed in the room, *i.e.*, the sashes were down; no change was made in their condition while I was there; don't remember anyone calling as a sitter while I was there, and Dr. B—.'s speaking of it; I did not know of Mrs. P—'s being in that house before she was brought upstairs; I don't remember speaking to Dr. B— of the fan, and requesting him to give me ether; from the time I closed my eyes after the ether had been taken, I did not open them until after the liberties had been taken; I did not open my eyes until he returned from the washstand; what I have described is from what I have heard and did not see; I did not see any part of his person exposed, nor the application of any part of his person to me; don't know, except from the pain, what part of his person was applied to me; he passed his hand up my arm immediately after he had felt my pulse; after the ether was administered a second time no liberties were taken; I judge that he did not see me when I opened my eyes, because he was not in front of me; when he told me he would have to pull the tooth, I asked him why; the reason why I agreed to take the ether a second time was, because I was afraid; I was not afraid to have my tooth taken out or to be operated upon further; I don't know if either of my teeth were prepared for plugging; I suppose he touched the tooth he took out; that gave me pain; I told him I'd had the toothache; another appointment was made for Monday at two o'clock; I asked him when I was to come again to have

them finished, and he said at that time; I asked him that when I was going and had my things on; he booked it at my instance; I don't know if it was before Mrs. P— came in or not; Dr. B— did not say there was a sitter waiting for the chair; I did not see any one call to inform him that there was a sitter; I never notice such small things as that; don't know how long after he had finished the tooth that he went down for Mrs. P—; I did not remain more than five minutes; Mrs. P— said she came from the country and came to have her teeth attended to; Dr. B— followed me downstairs; that is his custom, not only with me, but with other ladies; when at the door I did not manifest any displeasure with him; I told the doctor I wanted an omnibus; I believe I bid him good-by; soon after I got out of the door of the second story, I told him to say good-by to Mrs. P— for me, as I had forgotten it; the chair I sat in was the one I had always used; there was but one operating-chair in the room; Dr. B— asked me if I ever rode on horse back; I said yes, sometimes; he said, "Ride over and see us;" I replied, "Perhaps I will;" that was upstairs; on the way down to C—'s I did not meet any one I knew; I did not meet any one on my way to Third and Lombard Streets; I told Dr. B— I was going on an errand to Third and Lombard Streets; it was an errand for my sister in respect to some articles of dress; I did not speak to her of the treatment I received; did not sit down very long; when I left Dr. B—'s I think it was a few minutes before or after twelve o'clock; I don't remember which; I don't know how long I was at C—'s; not long; reached Mrs. T—'s a little after one o'clock; Mr. McK—, whom I met, asked after the family; I did not tell him where I had been; he only walked with me a short distance; I did not complain of any pain to Dr. B—, except the pain of my teeth; I don't remember how long the first application of ether lasted; after I took it I felt no pain in my teeth; cannot describe the effect of the ether, except that it made me dizzy; I did not see the doctor at all during the operation of the first ether; I felt his breath as well as felt pain; the pain did not continue long; I had no other indication of the approach of my monthly discharge, but that day; it occurred in the evening; I did not examine my person in the interval; nobody examined it between those times; I did not examine my garments; my mother did on Sunday afternoon; nobody before; those garments don't remain now as they did then; they are washed; I don't know when; I made the communication to Mrs. T— after tea on Friday evening; I told Mrs. T— before I became unwell; I gave evidence before the Mayor; don't know if the garment was washed before that; it was not washed until I went out home; during the time I was at Mrs. T—'s till I was taken unwell, no physician was sent for; I was never examined by a physician; on the afternoon of Friday I was out riding with Mr. and Mrs. T—; we set out about six; I do not

know where we went; somewhere on the plank road; it was sometime after I returned that I felt unwell; spoke to Mrs. T— on the subject after tea; we had tea as soon as we came home after riding; Mrs. T— told Mr. T—, and Mr. Thr— asked me a single question about it; I answered it, and that was all I said; it was before I felt unwell that I told Mr. Thr— about it; he remained as long as I did, and went to my grandmother's with me; on the next day I went out to the depot, but did not go to my father's; Mr. Thr— accompanied me to the depot; I met Mr. and Mrs. T— out there; I did not see my father or mother; I saw my father on Monday morning in Fifth Street; at the time he left to go downstairs; I did not see if he opened the door or not; I was sitting with my back to the door; I don't know why I refused to be introduced to the lady when he asked me the question; my father and Mr. Thr— accompanied me to the Mayor; Mr. and Mrs. T— and my two uncles were there; my father was there before I was.'

"*Re-examined.*—'I said that Dr. B— generally used me like a gentleman; he said a year ago that he should like me for his second wife; he had a good many children, but they should not trouble me, as he would get nurses for them; I spoke of it at home to my mother and sisters; after the doctor took me out of the chair after the operation, all that I said was in answer to questions by him, or to remarks; the reason why I did make another appointment with him (Dr. B—) was that I did not want him to know that I knew anything of his conduct; I had not concluded what course to pursue.'" The defendant's witnesses, however, proved the plaintiff was suffering from hallucinations.

Rape may be committed upon an adult woman if she falls into a state of syncope, or is rendered powerless by fright or terror, or from exhaustion from long struggling. Inability to resist from terror, as well as horror at her situation may lead a woman to succumb to the assailant without offering the resistance that is generally expected from a woman under such conditions. A woman yielding to the ravisher under threats of duress of death does not excuse the crime, and an aged woman can scarcely be expected to resist a strong man.

The question of pregnancy following rape has been agitated in the past by many authors. Conception does not depend upon the consciousness or volition of the woman, and it may take place if the uterine organs at the time are in a condition favorable, and if there is, also, present a healthy, living spermatozoon. (See also page 137.)

That a man can, during his sleep, unconsciously have intercourse with a woman must be a very rare occurrence. Taylor mentions several cases where the man was apparently asleep. In one case, a girl, fourteen and a half years old, was in bed with her two brothers, and was awakened by the pain caused by the attempt on the part of the older brother. He

excused himself on the ground of bad dreams and sleeping soundly. In such cases the defense is alleged impotence and that the local lesions upon the woman are self-inflicted, or that she gave her consent, and attempts to explain the local lesions as due to other reasonable and probable causes.

Evidence Found upon the Assailant.—An examination of the assailant may secure evidence of the alleged rape. There may be appearances about the genitals of the man which may confirm the charge. He may show evidence caused by the resistance on the part of the woman, such as bruises, finger-nail marks, bites, etc. Occasionally blood-stains may be found upon his clothing and even upon his person. If an examination of the assailant can be made before he has had any chance to micturate, seminal fluid may be found in the urethra. The presence of seminal stains upon his clothing are, of course, suggestive, but are less valuable evidence than their presence upon the clothing of the victim.

The age and vigor of the man may be out of proportion to that of the woman, and may in certain cases disprove the charge of alleged assault; that is, a boy or young man or an old, feeble man may be accused by a healthy, robust woman of this crime, but the disparity in vigor should be taken into account.

Occasionally it may happen that rape is perpetrated upon a dead woman, or that the woman dies during or as a result of other conditions attending the assault. She may be strangled as the result of an attempt to stifle her cries or she may be suffocated by having her clothing thrown over her head or asphyxiated by compression of the chest; or she may die from hemorrhage or from shock resulting from fright or from over-exertion in struggling, from apoplexy, or many other conditions.

The lacerations that are produced may result in the immediate death of the victim, as mentioned earlier in this chapter. In these cases it is often difficult to express an opinion as to whether violence was perpetrated before or after the death of the victim. At the best, only a probable opinion can be expressed. The detection of semen in the vaginal mucus or on the dress of the woman merely proves intercourse; it does not necessarily prove rape. Here other evidence must be taken into consideration, and each case judged upon its merits.

The crime of rape upon males by females is not recognized by English law. It is recognized by the penal code of France, which makes it a crime in either sex to attempt intercourse, with or without violence, when the child is under eleven years of age.

The unnatural offenses of pederasty, sodomy, and buggery are not of very unusual occurrence, but the reader is referred to the larger works on medical jurisprudence for further discussion.

CHAPTER XIV.

PREGNANCY

Signs of Pregnancy.—The suppression of the menses is commonly held by the laity to be one of the chief signs that conception has taken place, but this from a medical point of view is not a wholly reliable sign. Suppression may be brought about by many other causes, such as fevers, emotional disturbances, and disturbances of the general health, by typhoid fever, phthisis and nervous disturbances, etc. Conception may take place when the menses are absent from any other cause, as during lactation, or before the menses have been established in a young girl, or in old women after the menopause has apparently begun. On the other hand, the menses may persist even after conception has taken place, and may continue, in rare cases, up to the time of full term; so that suppression of the menses is not proof positive of conception, nor can it be maintained that because the menses persist that the woman is not pregnant.

Occasionally, in medico-legal practice we meet with cases of feigned menstruation, where a woman attempts to conceal her true condition, and resort is made to staining the underclothing or napkins with blood to simulate the staining of the menstrual flow. The gradual increase in the size of the uterus causes a corresponding enlargement of the abdomen, when the uterus rises above the brim of the pelvis, usually at the end of the third month; and this prominence of the abdomen is a well-marked characteristic of pregnancy. The increase in size is gradual and uniform until full term. With this gradual enlargement of the abdomen the surface shows numerous striæ which give it a peculiar appearance, but which is not necessarily diagnostic of pregnancy, simply diagnostic of enlargement of the abdomen. This enlargement may be due to other causes, such as pelvic tumors, ascites, suppressed menses within the uterine cavity, etc.

Changes in the breasts are among the most important changes during the progress of pregnancy; they gradually increase in size, beginning generally about the second month. There is increase in the glandular tissue which may exhibit points of tenderness. The pigmen-

tation, especially in the areola is noticeably increased. The skin of which the areola is formed becomes soft and moist, and the small glandular follicles in its neighborhood become prominent. But this prominence of the glandular follicles and the darkening of the areola may ensue from other causes, and at the best are only corroborative evidence. This increase in pigmentation is more noticeable in blondes than in brunettes. Some of these signs, such as the beginning enlargement of the breasts, accompanied by tenderness, and even with the secretion of colostrum, may be noticed just before the menstrual period in non-pregnant females, disappearing when the flow becomes established.

The presence of a fetus or other body within the uterine cavity may give rise to rhythmical contractions occurring two or three times an hour, and which may be felt when the uterus is above the pelvis until labor or until the body is removed.

At about the fifth month the woman first experiences fetal movements, which is commonly called "quickening", and it is of some importance in reckoning the duration of pregnancy, especially when the time of conception is in doubt. This condition is of more importance in diagnosis in multipara than in primipara. It may be entirely lacking during the full term of pregnancy in some cases, so that its absence is of negative value in the diagnosis of pregnancy. The time of quickening precedes that when the fetal movements can be detected by examination, so that if fetal movements can be felt by the examiner through the abdomen, this is not only evidence that the woman is pregnant, but that she has passed the period of quickening. As a rule, it occurs between the twelfth and sixteenth week, but may occur as early as the tenth or as late as the twenty-fifth week of pregnancy. Other signs of pregnancy which are of less importance are frequently a brownish ring extending from the pubes to the ensiform cartilage, but this increase in pigmentation of the linea alba may be due to other causes. As pregnancy advances, certain changes occur in the cervix and lower part of the uterus. As the uterus increases in size it descends into the pelvis, pushing the cervix down and nearer to the external orifice of the vagina. But in the later stages after the uterus has grown out of the pelvis, the cervix may apparently retract and the vagina be lengthened. At the same time the cervix becomes softer, beginning at the external os and continuing until the advent of labor, when the whole cervix softens and dilates. The lower segment of the uterus also softens, and more rapidly than the cervix. Hegar's sign is based upon this softening of the lower uterine segment. Another sign of pregnancy is the congestion of the vagina and the external genital organs, but this may be due to congestion from other causes than pregnancy.

"Morning sickness" is often experienced during the first months of

pregnancy. Occasionally this may persist throughout the full term and may be so severe as to demand interference for relief. Often there are abnormal cravings for food, and the patient shows a pronounced dislike for articles of food that she previously enjoyed. But this is only corroborative evidence at best.

The above signs are, at best, only probable signs of pregnancy, and in medico-legal practice should not be relied upon to give a positive opinion. Where a positive opinion is desired in medico-legal practice, it is best to postpone the forming of an opinion until positive evidence can be obtained. The changes in the cervix and in the uterus are too uncertain to enable one to form a safe opinion, and it is impossible to trust to external signs alone. Positive evidence may be obtained by distinguishing a rounded body floating freely in the uterus, which exhibits rhythmical contractions by the movements of the fetus, and by the sounds of the fetal heart. This latter sign is detected by auscultation. The pulsations are not synchronous with those of the mother, and are much more rapid. They may be heard as early as the fourth month of pregnancy, but are best heard at the sixth month. Their rate is inversely to the period of gestation; that is, they are more rapid in the earlier months, being as high as 160, and slower in the later months of pregnancy. This sign is not only evidence of pregnancy, but further that the child is alive. On the other hand, auscultation may not detect the fetal sounds, even when the child is alive, or they may be temporarily obscured only to reappear again later. The presence of much adipose tissue upon the abdomen of the mother may interfere with their transmission, and a large quantity of liquor amnii may intercept them. On auscultation one may detect sounds other than those of the fetal heart, the so-called "umbilical souffle", or "uterine bruit". These signs may be heard generally after the third month, and are not diagnostic of pregnancy.

The quickening which is experienced only by the mother may be followed in the fifth month by active movements of the child which can be felt by palpation of the abdominal wall. These movements must not be confused with peristaltic movements or muscular contractions of the mother's abdomen.

Later, as pregnancy advances, the fetal outline can often be made out, and if the whole fetus can be outlined there is no other condition that can be mistaken for pregnancy. But the feeling of only parts of the fetus may be mistaken for various other conditions, such as tumors, etc.

Extra-uterine pregnancy is not uncommon. In these cases many of the above signs are modified, if not lacking. The presumptive signs of early pregnancy, such as the cessation of the menses, the changes

in the breasts, morning sickness, etc., may be present the same as in normal pregnancy.

As a rule, pregnancy of this nature does not develop to full term. Often they terminate themselves by rupturing into the peritoneum, or are terminated on account of the symptoms produced.

Finally, we may say that a positive diagnosis of pregnancy can only be made after the detection of the fetal heart-beats, the fetal outline, or the fetal movements, and therefore, only when pregnancy is well advanced, probably not before the fifth month, and that early pregnancy may be diagnosed based on the presumptive signs, but that one cannot form a safe opinion in all cases.

It is possible that women may become pregnant without being conscious of it. Many authentic cases are recorded in medical literature of women who have been delivered of full-term children and have disclaimed all knowledge of their condition until the child was born. Pregnancy existing in a dead person is not required by law to be verified, although its absence may assist in the identification of a body or save the deceased from the charge of unchastity. It should be remembered that the uterus in its virgin state is the last organ to undergo decomposition. The discovery of an embryo or a fetus with its membranes in the uterus, of course, settles the question, but in cases where the examination is made long after interment, there may be nothing left but the skeleton. In these cases if the fetus had reached the period at which ossification takes place, traces of its bones will be found along with those of the mother. Of course, the practice of burying a fetus with a woman with whom there exists no relation is possible and must be borne in mind.

Formerly it was thought that conception could not take place without the consciousness and will of the woman, but this theory is without foundation. It is difficult to admit, however, that the woman can remain pregnant up to the time of delivery without being conscious of her condition, whether or not she was conscious at the time of intercourse. It is not probable that she could go beyond the sixth month without being aware of her condition. Further, the opinion used to prevail that women did not become pregnant following rape, but women may become pregnant during the states of asphyxia, intoxication, or narcotism. Frequently, in married life, women become pregnant against their will and often their condition is far advanced before they are conscious of it. That pregnancy following alleged rape is proof of the consent on the part of the woman is absolutely erroneous.

In English jurisprudence the proof of the pregnancy of a woman may be required in two instances. In civil law it may be necessary where a

woman maintains that she is pregnant and likely to give birth to a posthumous child, the heir at law to an estate has a right to have her statement verified, and proof given that she is really pregnant. If the examination is made early in the pregnancy, it may be unsatisfactory, and further examination at a later date may be necessary. In criminal law a woman convicted for capital punishment may plead pregnancy as a bar to her execution. If she is pregnant the execution of the sentence is postponed until after her delivery.

The duration of pregnancy had always been held to be nine calendar months or ten lunar months approximately. The exact number of days is a question which is still open to discussion. The chief difficulty in determining the duration is the fact that it is not always possible to fix the time of conception. Whether conception takes place within the uterine cavity or in the Fallopian tube has not been definitely determined although it probably takes place in the latter. Menstruation probably takes place at the same time as ovulation. Conception may take place just after menstruation or just before the expected time of the next, and this menstruation be omitted. The usual method of reckoning is from the cessation of the monthly flow; that is, we count ahead nine calendar months, and add seven days to the date on which the last menses appeared. This date is the one on which labor may be expected to occur, but a week before or after that date must be allowed, as very few fall on that particular date. The period of normal gestation is approximately 280 days, or ten monthly periods, and the slight variation may be accounted for by the normal variation in individual cases; that is, a woman may occasionally go over her period two or three days, in which case her period of gestation would be a few days more than 280. Various authors have placed the limit from 272 to 290 days, with a minimum of 250 and a maximum of 326.

The limits of variations from the usual period of gestation are very important from a medico-legal point of view. Here we have the question bearing upon the length of time that man and wife can be separated and still the woman bear a legitimate heir to her husband; how soon after marriage can a viable legitimate child be born? etc. And here we meet with wide divergence of opinion, so that it is almost impossible to fix any definite time. As the period varies in the lower animals to a wide extent, it is not unreasonable to assume great variation in the time of human gestation. Most authors are willing to concede a limit of 320 days.

With prolonged gestation other evidence of protracted pregnancy will be observed. The length and weight of the fetus will, to a certain extent, increase the longer the gestation. But even here we may meet with fetuses that are larger, heavier, and more mature than normal, but

which have not been carried more than the normal period of 280 days. There is, no doubt, a limit to gestation, but we are unable to fix it. The various writers on obstetrics adopt periods which are at variance with each other. Some stop at 280 days, others give a maximum of 293, still others 325, and one author allows 365 days, or one year; so that at present other circumstances must be taken into consideration in cases where this question is involved. The State of Pennsylvania allows one year as the longest period for a married woman to have a child in the absence of her husband. Beyond that there is no law of the other States, nor has the question been decided in the United States, at least so far as we know. No time has been fixed by English law beyond which a child if born in wedlock would be presumed to be illegitimate, and in this country the decision would rest upon the opinion of experts and each case be decided on its own merits.

In contradistinction to prolonged gestation, we will now take up the early limit of pregnancy. Births before the thirty-eighth week may be regarded as premature. The fact that a child survived its birth for a certain period is supposed to furnish evidence of maturity, for it is known that under a certain age children are not born alive, and if living, they speedily die. Children born at the seventh month of gestation are capable of living, although they are more delicate and generally require greater care and attention than children born at full term, and the chances are against their surviving. The opinion of Hunter, and one with which modern authorities agree, is that few children born before seven calendar months (210 days) are capable of living to manhood. Those that are born earlier than the sixth month commonly die soon after birth, as well as those born between the sixth and seventh month. There is one case of a child born alive as early as the fourth month. Numerous authentic cases are on record where fetuses have been born alive at the fifth month and have survived for from twelve to thirty-six hours. They exhibited respiration and heart-beats, took nourishment, and could be said to have lived for a certain length of time. Rarely such cases of short gestation have survived for many months or even years. So that it may be considered that children born at the seventh or even about the sixth month may be reared, and that their survival cannot in any way be taken as a proof of their illegitimacy. The development and condition of the child is of far more importance in forming an opinion than is the mere period of gestation.

The age of the fetus may be approximately determined often from its weight and length. Here, as in reckoning the period of gestation, we are at a disadvantage in not knowing exactly when conception took place, and the figures below are estimates for determining the period of gestation by the degree of development:

At the end of the sixth (calendar) month the fetus is approximately 35 cm. in length, and weighs a kilo; the average increase in length is 5 cm. a month, and the average increase in weight, 375 grams.

The popular idea is that ovulation is suspended while the uterus is functionating, but this is more supposition than is capable of proof by evidence. For there are undoubted cases of one pregnancy being superimposed upon another, and this implies at least ovulation during pregnancy. This is undoubtedly more easily accomplished during the first few months of pregnancy when the uterus is not completely filled with the fetus and its membranes. There are many cases of one pregnancy following another in the same woman with a period of less than nine months between the births of the infants.

Further, we may have twin pregnancies where the children may exhibit different physical peculiarities: one may be white, the other colored. Second, two or more fetuses may be expelled at practically the same time that are of unequal development. Instances of the simultaneous birth of two fetuses of different development are not rare. One case is reported where a woman gave birth to twins of about 5 inches long (4½ months), and a few hours later a single birth of an infant 15 inches long, about 7½ months. Another case of the delivery on the same day of one child at full term, and a fetus 1 inch long, in which the eyes and rudiments of the extremities could be seen, and the age was estimated at six or seven weeks. Further cases are found where women are delivered of two children at term at intervals of less than nine months. One such case is reported at an interval of five months, another of four and a half months, and five and a half months, respectively. These latter cases may be explained possibly on the theory of twin pregnancies where one of the fetuses gains in development at the expense of the other. Occasionally we meet with twin pregnancies where there is undoubted malformation and even death of one fetus caused by the growth of the other. The rare condition of a double uterus with a single cervix, or two cervices and a double vagina, may, of course, lead to twin pregnancies, but the uteri in these cases being independent of each other, the pregnancies are normal.

Occasionally it is of importance to ascertain whether a woman has been pregnant previously or not. If there are at hand the evidences of pregnancy, such as an expelled fetus, then the question is easily settled. But the marks of pregnancy do not always remain to settle the condition. The peculiar striation or linea albicantes are seen upon the surface of the abdomen, but they are not evidence necessarily of recent child-birth, nor are they evidence always of preexisting pregnancy. The breasts also may retain their striæ. The size of the uterus is changed by pregnancy from the small uterus of the virgin to the multiparous one,

which is about one-third larger, but similar changes may be caused by disease or operation. Laceration of the perineum is frequently found and destruction of the fourchette, and these are diagnostic of previous delivery if traumatism can be excluded. Cervical lacerations are still more characteristic, changing the oval os of the virgin to the transverse slit of the previously pregnant woman. The greater the laceration, the more characteristic is this evidence.

Signs of Recent Child-Birth.—These may be divided into two classes, and of the first we will make two subdivisions. There are several doubtful signs which are by themselves of little value; the wrinkled skin of the abdomen; its pigmentation and the linea albicantes; and there may be a varicose condition of the veins of the lower extremities. Profuse sweating, sleepiness and exhaustion, pain in the breasts and genitals, after-pains and painful micturition may all be present. Yet they are not conclusive of child-birth; they are merely corroborative evidence and at the best only suggestive of this condition, as one or all may be present in a person who has not passed through child-birth.

The next group of signs are of more value, yet they are not diagnostic, necessarily, of child-birth. These are local signs appearing in the genital tract and mammary glands. The breasts are enlarged and knotty, their areolæ pigmented and the skin dry; the veins are swollen, and there are generally the so-called tubercles of Montgomery in the areolæ, and colostrum followed by the secretion of milk is present. The secretion at first is scanty, thin, and watery, but on the third or fourth day the breasts become tender and more tense, and the colostrum is replaced by milk, although the colostrum corpuscles may persist until the ninth or tenth day. The breasts become soft and pliable if relieved of their secretion, and steadily produce increasing quantities of milk for a long time to come. If they are not relieved they become hard, lumpy, and painful and may develop abscesses; but this symptom may be produced by conditions other than pregnancy, and is not a positive sign of recent delivery, though suggestive.

The genital canal shows signs which are suggestive, though not absolutely proof positive. The vulva is swollen, edematous and pigmented; the vagina relaxed and distended so that the whole hand may be passed into the uterine cavity. The secretion is more or less profuse and the parts are likely to be covered with blood, vernix caseosa, and, perhaps, with meconium. After the second day, though, the discharge contains more mucus, and after the seventh day it becomes paler and glairy, gradually disappearing. The vagina gradually contracts to nearly its former size, the cervix of the uterus becomes smaller and firmer, admitting for days two fingers, but at the end of the week only one finger, and shows fissures. The fundus of the uterus is to be felt above the pubes,

at first gradually contracting until at the end of the second week it is behind the symphysis.

At the best, these signs are only suggestive, and even when all are present are merely confirmatory. The positive proof is detection of parts of the ovum. We may find by microscopic examination of the lochia elements of embryonic development, or failing this, we may obtain a bit of material from within the uterus by curetting. Identification of the placental tissue or bits of decidua, or of the chorionic villi is proof positive of recent child-birth.

Any opinion as to the length of time intervening since child-birth is at the best only an approximate one, as the longer the interval since child-birth the more difficult it is to form an opinion. The general appearances are present only for a few days at the most, and even laceration or contusions will mostly disappear by the fourth day or be so changed in appearance as to be of little diagnostic value. If the woman is a primipara, the various signs may persist longer than in a multipara, but an examination a week or ten days after child-birth in the multipara is apt to be unsatisfactory for forming a definite opinion as to the interval intervening, or even in some cases as to the actual occurrence of child-birth. In all of these cases, of course, the detection of the tissues mentioned above furnishes us a conclusive basis for diagnosis.

The above signs are those of child-birth at full term. If it is a question of miscarriage or abortion then our task becomes increasingly more difficult as the signs are less and less characteristic. As the signs depend upon the size of the fetus, delivery before the fourth month may appear to be nothing more than a painful menstruation, and even though it was procured by instrumentation, the unusual flow and pain could be covered up by the woman as not to excite any suspicion at all. Between the fourth and sixth month it would be very difficult to form a positive opinion. Here the depth of the uterine cavity might be of assistance, or hemorrhage, tenderness in the epigastrium, and the unusual dilatation of the cervix. After the sixth month a miscarriage leaves symptoms and signs similar to those of child-birth at full term.

The above has reference to an examination made upon a living subject where the woman has preserved silence. Of course, if she confesses and tells the physician the true condition of affairs then his task is easy, and his examination is corrobatory. If with the symptoms and appearances above described an ovum or embryo is found, then the diagnosis is complete.

Postmortem Appearances.—The preceding has to do with signs and symptoms in a living woman, with or without her advice and help. But we may be called upon to decide the question of child-birth, either by abortion, miscarriage, or at full term, in a dead body. This

occurs particularly after criminal abortions that have gone wrong. The external appearances already described will be in evidence, and also certain lesions and changes about the pelvis that can only be seen post-mortem. The uterus is, of course, enlarged according to the period of gestation at which delivery took place, and further, influenced by the time that has elapsed between the delivery and death. If the child-birth was at full term, or near it, and the woman survived from twenty-four to thirty-six hours, we would find the uterus approximately seven or eight inches in length, and from four to six inches in breadth externally. Its wall would be from one inch to one and a half thick, and it would weigh about one and a half pounds. The uterine cavity would be found to be covered with a reddish fluid about as thick as thin cream, with a characteristic odor, and which could easily be removed by a gentle stream of water. The mucous membrane of the cervix might have a peculiar orange color, and the cervix itself show more or less ecchymosis and bilateral tears. Occasionally the placenta or portions of it are found within the uterus, and, of course, furnish positive proof of recent pregnancy and delivery. This sign is available after a woman is two months pregnant. If it is found disorganized, its presence is of no assistance in determining the length of time since delivery.

The size of the site of the placenta in the third or fourth month is about that of a silver dollar gradually increasing until it becomes as large as the palm of the hand. The contraction and involution of the uterus reduces its dimensions. The mucous membrane shows the irregular surface of the detached decidua. The placental site is about 10 cm. in diameter, and at the end of one week it has been reduced to 3 or 4 cm.

Cases that come to autopsy as the result of abortion, whether it be accidental or criminal abortion, may be divided into two classes: those of sudden death due to air embolism or other accident and those of death following, as a rule, secondarily, from the effects of the abortion. Occasionally in the latter cases we find direct evidence of mechanical interference, such as punctured wounds of the uterine wall, bits of the broken instrument within the uterine cavity or firmly held in the cervix. By far the largest number of cases is due to septic peritonitis caused generally by the use of dirty instruments. Among other causes may be mentioned hemorrhage or death by poisoning from an overdose of an abortifacient drug.

Where the death was from sepsis, the anatomical appearance of abortion, whether accidental or criminal, may be modified or masked to a considerable degree. The course of septic peritonitis is long enough to permit the tissues to recover from their primary injuries, so that in many cases one can only say that the appearances are consistent as a result of abortion, although not proving it absolutely. In other words,

one may say that there has been a pregnancy followed by a miscarriage and that resulted in septic peritonitis; but that the abortion was criminal or accidental, he cannot say. This condition of septic peritonitis is due, as already mentioned, to the use of dirty instruments; in other words, to the ignorance, unskillfulness, or carelessness, and may be the haste of the operator, and hence the popular term of "malpractice".

The physician who attended the victim during her life may inadvertently or innocently obliterate the anatomical evidences of abortion which the uterine cavity would show. Curetting is an invaluable means in the treatment of this condition, but unfortunately it removes evidence upon which the medical examiner places much reliance, and unless the "dying declaration" is available for direct evidence, most of these cases cannot be pushed to the conviction of the guilty party.

Abortion is recognized as a legitimate medical procedure in special cases to avoid the risk that would attend the delivery of a child at full term—risks that apply both to the child and to the mother. The mother may have a contracted pelvis or she may exhibit symptoms of eclampsia, placenta prævia, or some other condition which threatens her life. Further, the uterus may be so small that a full-term child cannot be born alive, and here in the interest of the fetus an abortion of a viable child may be indicated. In all such cases the physician should call in consultation another colleague so that he may not expose himself to reproach or prosecution. Here the attitude of the physician may save him from reproach. If he does it openly and above board with the evident desire to save the mother or the child, he is more likely to avoid suspicion than if labor is induced secretly.

The corpus luteum was formerly supposed to be characteristic of pregnancy, but this has been proved erroneous. The corpus luteum of menstruation from a ruptured Graafian follicle is identical with it, and its retrograde changes are the same. The only difference between the two is in the rate and degree of the changes taking place. The corpus luteum of menstruation attains a maximum size in eight or ten days, and then atrophies so that at the end of six weeks it can scarcely be identified as a mere scar. The corpus luteum of pregnancy develops during the first week similar to the corpus luteum of menstruation, and continues to develop, though much more slowly, until the end of the third month when it begins retrograde changes, arriving at the time of full term at about the same condition as the corpus luteum of menstruation at the end of the third week. To say whether a given corpus luteum is one of menstruation or pregnancy, and thus be able to determine whether a woman is pregnant or not, is a question which has given rise to a great deal of discussion, both in general and medico-legal practice. But there is a lack of agreement among physiologists, obstetricians, and medico-

legal authorities, so that an expert may well be on his guard in expressing an opinion. There are differences between the two kinds without doubt, but they are so easily modified that we cannot use them as controlling signs in post-mortem diagnosis. At the best, they are only confirmatory evidence, and are not positive proof of pregnancy.

The walls of the uterus also show characteristic changes. The walls of the virgin uterus are about 10 to 15 mm. in thickness, while the walls of the parous uterus are nearer 20 mm. in thickness. The tortuous blood-vessels throughout the uterus, and more distinct in the outer portion of the muscular layer, are characteristic.

Recent menstruation may simulate the condition of the uterus two or three months after delivery, but the absence of the placental site, the presence of the enlarged tortuous blood-vessels, and the cervical lacerations are evidences of previous pregnancy which would not be present in simple menstruation.

Cases of feigned delivery are occasionally met with in medico-legal practice, the motives of which we need not enter into here. But though such cases make interesting reading, we have omitted them here as they are so easy of detection on examination by a competent physician.

Premature child-birth may be induced accidentally, innocently, or intentionally—that is, criminally. The accidental abortions are caused by some abnormal condition of the mother or fetus. Fevers, especially of an infectious character, chronic pulmonary or cardiac disease, syphilis, acute poisoning, and acute Bright's disease, are all systemic causes which may lead to premature birth. Local causes, such as abnormal flexion of the uterus, pelvic adhesions, endometritis, etc., as well as physical causes, such as violent exercise, horse-back riding, falls, blows, and even fright, anxiety, and shock may all cause it. On the part of the fetus, disturbance of its nutrition, that is the placenta, apoplexy, syphilis, or even its own malformation may cause its extrusion from the uterus. In other words, any condition, maternal or fetal, which interferes with the nutrition or development of the fetus or causes its death, may be considered a factor in accidental abortion. Medico-legal investigation has not to do with such cases, where satisfactory evidence offers a probable and reasonable explanation of the accident. It has to do with those cases where such conditions are not evident; that is, where it was a criminal act. Evidence pointing to this may be derived from many sources. If we know a woman's character and are aware of her behavior immediately before and after the abortion, together with the subsequent symptoms; if we may make an inspection of the body, living or dead; if we can make an examination of the fetus known to have come from the woman's uterus, then we may be able to form an opinion and

to testify in court. A determination of the woman's character and her actions are, strictly speaking, not in the province of the physician; they are rather police questions.

The use of drugs to produce abortion dates from time immemorial. The efficacy of so-called abortive drugs is a matter of doubt, and depends so much upon the individual idiosyncrasy and predisposition that their value is very uncertain. Many women are predisposed to abortion on the slightest provocation. The least departure from their usual habits may bring on this condition; and if these women do not wish to miscarry they must exert great care in their daily routine, especially if the habit of miscarriage has become established. In such cases, any drug with a reputation as an abortifacient might produce an abortion. On the other hand, many women will go through their pregnancy, and suffer many accidents, or they may take all kinds of drugs without in any way affecting their condition. Many of the so-called "female regulators" comprise the usual class of abortifacients. Many such preparations are on the market and are easily obtained, and, in fact, the warning printed on the label that such drugs should not be used by women in a delicate condition, is their way of evading the law and increasing their sale. Many druggists of good repute sell not only these quack medicines, but condescend to put up their own to bring about this condition. The woman who resorts to the use of such means has but one idea, namely, to produce an abortion. She cares nothing for the other effects, no matter how unpleasant or serious they may be, from the ingestion of an overdose of some dangerous drug. Aloes, cantharides, cotton root, croton oil, cedar oil, elaterium, ergot, and pennyroyal form the basis of most of these so-called "regulators". In large quantities they may produce not only serious, but fatal results.

An abortion produced by these drugs or in any way attributable to them can hardly be differentiated from an accidental miscarriage. The uterus shows no characteristic appearance to tell whether drugs or accident produced the miscarriage.

Many women resort to increased exercise or even violent exercise in order to abort. Long walks, tight lacing, running up and down stairs, horse-back riding, and other violent exercise has been resorted to and occasionally with the result desired by the woman. On the other hand, the same condition holds true as with the use of drugs. Many women may undergo all of this and more, even extreme violence, where they may suffer contusions in their efforts to get rid of the fetus, and still the fetus remain intact and be born alive at full term.

Here, too, the appearances indicating the abortion may be similar to those due to accidental occurrence. The physician, except for congestion or other local marks of violence, would be unable to differentiate

between an abortion as a result of violent exercise or one occurring accidentally.

In distinction from these various means to produce abortion already described, we come to the signs of abortion where it has been produced by mechanical means intentionally. These vary from safe, approved methods, used by regular practitioners in good standing, to the most cruel and barbaric that ignorance can contrive. The most common instrument is an elastic male catheter introduced into the uterus and allowed to remain there, but a wide range of other instruments have been employed such as probes, trocars, knitting needles, pieces of whalebone, wire, toothpicks, hairpins, sticks, tents, and even shears. The hand alone or even the finger may be sufficient occasionally. One author asserts that injection of water into the uterine cavity is the most common procedure in America, and that puncture of the membranes is usually employed in France. Occasionally the abortion is performed under strict asepsis and aided by proper surgical technic, the result is satisfactory. It does not seem possible that a woman could produce an abortion on herself by instrumental means, from the relation of the external orifice to the cervix, but many cases are on record where it has been done.

Hofmann reports a case "in which a woman produced an abortion on herself by means of a knitting-needle, and another in which a woman used the whale-bone rib of a parasol in her genitals."

Witthaus and Becker quote the two following cases: "1. A woman used a flexible rubber sound, first disinfecting it in a 2 per cent. solution of carbolic acid. She successfully introduced it and left it until uterine pains came on, when she removed it and a miscarriage occurred. She had done the same thing three years before. 2. A woman, two months pregnant, passed an elastic catheter into her vagina, shortened by cutting off the anterior end. It was stiffened for its passage by means of a stylet. She felt pain, and supposing the instrument had entered the cervix, removed the stylet. Some blood came, and symptoms of fever and peritonitis followed. She miscarried six days after the catheter had been put in. The instrument could not be found, but after two months it was passed from the rectum. The patient was a married woman and there was no attempt at concealment. She had successfully passed a catheter into her womb and induced miscarriage in three previous pregnancies."

During delivery of the child and of the placenta, massage of the abdominal wall is frequently employed to set up uterine contractions, and this method has been used with varying success as a less violent means of securing abortion. Other means not quite so civilized or refined have been used, such as raining violent blows upon the abdomen,

the idea being that the fetus is destroyed and the membranes detached from the uterine wall, and expulsion follows.

When abortion has been produced by instrumentation, there is generally experienced more or less pain as the point of the instrument passes through the cervix. It may be severe and even accompanied by shock. A little blood generally appears, and occasionally liquor amnii. The abortion may be immediate or it may not follow for a week or even longer. There is generally a moderate discharge and convalescence is of short duration in successful cases. If the abortion has been attempted during or after the third month of pregnancy the retention of the placenta is a source of danger. If it is retained the hemorrhage continues and may be severe enough to cause alarming symptoms, and it may produce an offensive vaginal discharge or even sepsis.

The evidence of abortion may be procured from the fetus or from the mother. As to the signs afforded by the fetus little can be said. If the abortion was produced accidentally or by drugs or exercise, the appearances are practically the same, and little evidence of a criminal nature can be obtained. If it was produced by mechanical means in addition to the ordinary appearances, there is the evidence of the instrument. This may be seen in various traumatic conditions of the amniotic sac. The ruptured ovum is strong evidence of interference, or the fetus itself may show strong evidence of the means employed, such as wounds or injuries from the pointed end of the instrument, such as a skewer perforating the skull.

The signs present in the mother may be considered under two heads—symptomatic and local: intense pain in the pelvis and epigastrium, and a feeling of weakness incommensurate with the amount of hemorrhage, although the latter may be severe, nausea and vomiting. The local injuries vary widely. They may be slight as the result of the skill of the operator, or they may be severe, where it was performed ignorantly. Often bits of the instrument are found broken off within the cervix. The injuries to the vagina, cervix and uterus are often visible. Occasionally the instrument pierces the uterine wall, even in the hands of a skilled operator. If the instrument is sterile and surgical asepsis carried out the danger of infection is slight, but if it is produced carelessly or ignorantly then septic infection is not uncommon. The patient may give a history of shock, followed by expulsive pains, and inspection of the genital tract reveal lesions inconsistent with the claim that the abortion was accidental. There may be heat, tenderness, and an edematous state of the cervix, which is lacking in accidental cases. The sepsis is marked by the usual symptoms of chill, nausea, tenderness, fever and, locally, by a vaginal discharge which is foul. Rarely, however, are physicians called in in the initial stage of this dilemma. Gen-

erally the "regular" physician is not sent for until sepsis has become well established. He then notices a fetid vaginal discharge, distended and tender abdomen, chills and vomiting, and an anxious expression of the countenance; the temperature and pulse are consistent. Here the physician may be on his guard, for he may desire to make a vaginal examination to satisfy himself of his suspicions. This the woman has a right to forbid, as she is not obliged to give evidence against herself, and if an attempt at examination is made against her will, then by law the physician may be guilty of assault.

CHAPTER XV.

INFANTICIDE

By the term infanticide we mean the criminal killing of an infant. In America, this is not a specific crime by itself, but is included in the statutes under homicide. Like other descriptive terms, such as matricide, fratricide, etc., it is useful to convey a distinct meaning in a given case. The Statutes of Massachusetts place it in close relation with another crime, concealment of the death of an illegitimate child.

Section 17, Chapter 212, says: "If a woman conceals the death of issue of her body, which, if born alive, would be a bastard, so that it may not be known whether such issue was born alive or not, or whether it was not murdered, she shall be punished by fine, not exceeding $100, or by imprisonment in the jail, not exceeding one year." And section 18: "A woman indicted for the murder of her infant bastard child may also be charged in the same indictment with the offense described in the preceding section, and, if on trial, the jury acquit her of the charge of murder, they may find her guilty of the concealment."

Infanticide may be by an act of commission or by an act of omission. In the former, by wounds, drowning, strangulation, etc., and in the latter, by exposure or neglect. At all events, it is the intent which constitutes the crime, and stronger evidence of the intention is required than in other cases. To prove a person guilty of infanticide it must be proved that the child was alive after birth. The law presumes that the child was born dead. The burden of proof is on the prosecution to prove that the child survived birth, and that it was legally a living child that was deprived of its life. To prove that the child was alive is often difficult. The duration of life is of no importance. Respiration is a true sign of life always, but the reverse is not true, that the child is dead because it has not breathed. Crying is an indisputable proof of life, and in Scotland is required as proof in order to establish civil rights. It, of course, necessarily implies the act of respiration. The opening of the eyes, the twitching of the lids, the flexion of a limb, or any muscular movement, has been held as sufficient evidence that the child was alive. Pulsation in the navel cord is another clear sign of life, indicating the

action of the child's heart. The pulsation of the child's heart is the chief of all physical signs, and is more important than crying, respiration, or movement on the part of the child.

Infanticide is not only the killing of an infant, but that infant, according to law, must have been born completely. If any part of the child's body is within the mother, the law says that it is not infanticide. By law the birth of the child must be complete. The killing of a child, even though it may have breathed, that has not been completely born, is not infanticide. And also the rule is that the child must be proved to have possessed an independent circulation at the time of the death. By this we understand that condition in which, whether breathing occurs or not, the blood no longer passes from the mother to the child. That is, the navel cord no longer furnishes communication between the child and its parent. While a violent death may be perpetrated on a child before it is completely born, and as above remarked is not infanticide, still the law states that a child that has suffered violence either before or during its birth, from which it later dies, after its complete birth, is a crime punishable as homicide. So that, even in obstetrical practice, where a physician may be obliged to sacrifice the life of a child for the sake of its mother, and the destruction is accomplished while the child is in utero, he is spared the scruples of the law, as he has not committed infanticide. Always bearing in mind that the presumption is wholly favorable to the accused, and that it is upon the officers of the State to prove that the child died by violence.

Evidence of Live Birth.—If the child is born alive we have the evidences of life vaguely shown in certain general conditions, and absolutely proved by the conditions of the respiratory and circulatory systems. The general signs include the appearance of the hair, the ears, the half-open eyes, the expanded thorax, in which the diaphragm has descended from the level of the fourth or fifth rib to that of the sixth or seventh, and the discharge of meconium and urine.

In the respiratory apparatus are the most trustworthy signs of life. The distended lungs, with air in the air vesicles are characteristic of respiration. With the first inspiration the lungs expand and cover the heart and thymus; they become filled with air and show a change in color, from a dark bluish appearance to a bright red. The surface shows the markings of the lobules and air vesicles, and the tissue crepitates between the fingers and floats in water. Microscopically, the character of the tissue is changed from the spongy structure to that of the characteristic air-cell and air-vesicle structure of the dilated lung.

The comparative weights of the lungs both before and after respiration, both absolutely and proportionately to the entire body-weight, are of some importance. So far as their absolute weight is concerned, this

varies with the size of the child and, therefore, no definite weight can be established above which it can be stated that the infant breathed, or below which it can be stated that it did not breathe. The relative weight of the lungs to the entire body-weight is of some importance. Before respiration it is generally considered that the lungs are about $\frac{1}{70}$ of the entire body-weight, and, that after respiration they are $\frac{1}{35}$ of the body-weight. This is of doubtful value, especially so when it is claimed that the child may only partially complete the act of respiration.

The hydrostatic test is the one upon which the greatest reliance is placed, and upon which the decision is based in the majority of cases. The test depends upon the decrease in the specific gravity of the lungs when they are filled with air. Brouardel speaks of five steps which should be used in this test, and which, if they are all positive, leave no room to doubt that the child breathed. The five steps are as follows:

(1) After opening the thoracic cavity and neck, clamp the upper extremity of the larynx and esophagus, and sever just above the clamp down to the vertebral column. Follow the vertebral column down to the diaphragm, removing all the thoracic organs together, and then cut out just above the diaphragm. With the larynx downward, put the entire mass in water, remove the clamp, and let go. If the infant has breathed fully, the whole mass floats without trouble.

(2) Remove the heart, thymus, and esophagus, and put the respiratory organs by themselves in the water. If the child has not breathed they will sink to the bottom permanently, but if the child has breathed they will float without trouble.

(3) Cut the lungs into pieces, hold them under water with the cut surface uppermost and compress. Air bubbles and serum exude, floating upon the surface of the water if the infant has breathed.

(4) The pieces of lungs that have been compressed still float if the child breathed.

(5) When the lungs float, take one of the pieces, squeeze it, grind it to a pulp, and if it still floats on being put back into the water, the child has breathed.

The objection to this test is that although it may prove that the child breathed, it does not prove that the child sustained a live birth, for, as has already been mentioned, breathing must take place after the child is completely born. There is no question but what the child may breathe while some part of it is within the mother.

Any process which lessens the specific gravity of the lungs would tend to make them act in a way similar to that described above, but in such cases as caused by freezing, the circumstances connected would easily differentiate. Artificial inflation of the lungs is conceivable, but is so improbable as to be hardly worth mentioning. In this case usually the

upper portion of the right lung is dilated, and only this. Further, there is no pulmonary circulation, and hence the lung is white and anemic, and has not the color of the normal lung that has breathed. Putrefaction may lead to the formation of gases which will float the thoracic viscera, but if the previous order in performing the hydrostatic test is followed, it will be found that lungs that have undergone putrefaction will be eliminated at the second stage. Further, putrefaction of the lungs is accompanied by decomposition of the other organs. Moreover, putrefaction of the lungs of a gangrenous nature, does not take place unless the infant has already breathed. Therefore, putrefaction is in itself more or less evidence of breathing.

We must consider also whether the sinking of the lungs always proves that the child did not breathe. Here we must bear in mind that we may have a case of pneumonia or congestion of the lungs, whereby the buoyancy of the lungs is interfered with. Atelectasis, or the imperfect expansion of the lungs, may cause them to sink when placed in water, although the child may have breathed from six to thirty-six hours.

The presence of the caput succedaneum used to be considered positive proof of the circulation on the part of the child, at least during part of the labor. But this exudation, which used to be thought due to constriction of the venous circulation, has been shown to be due to decreased pressure on that part, and would be the same whether the child were alive or dead.

Duration of the Child's Life.—Often it is important to determine how long the child lived, granting that it was live born. The lungs containing respired air show that the child lived at least long enough to take one full breath, although this breath may have been taken before actual birth. The examination of the stomach shows that it is filled, probably before respiration, with mucus, and in the first few minutes, this mucus becomes mixed with air, forming a foam, which disappears in a few hours. Therefore, if this foamy mass be found within the stomach the life of the child must be considered as limited to a few hours. The introduction of milk or food into the stomach shows that the child lived at least an appreciable length of time. With the tying of the umbilical cord there is the formation of clots in the vessels of the cord. On the other hand, if the cord is not severed it would limit life to a few hours, and might show the intent of the mother.

The drying of the cord used to be considered a sign of life, but it has been shown that the cord dries under the same conditions as quickly on the dead child as on the living one. At birth the cord is bluish white in color, but after birth it soon loses this appearance and becomes dry and flaccid. The cord separates usually on the fourth, fifth, or sixth day,

followed by cicatrization of the navel, which is generally complete on the fifteenth day.

Beginning desiccation of the skin usually occurs within twenty-four or forty-eight hours, and lasts from one to five days; hence, if present, we may consider the infant to be at least two days old. The closure of certain blood channels was formerly considered evidence of live birth, but the foramen ovale and ductus arteriosus are found open, occasionally, even in adult life.

Ossification of the lower epiphysis of the femur is of great importance in determining the age of the child. At birth it is from 2.5 to 5 mm. in diameter, and if it is more than the latter the child has probably lived more than ten days, if the birth was at term, and the duration of pregnancy was not protracted. Occasionally cases are found where the child has lived for this length of time after birth and no center of epiphysis found.

The causes of death during parturition may be spoken of. The placenta may have become detached, and the fetus not being able to receive air from the outside world, might die from asphyxia. The umbilical cord may become prolapsed and compressed, shutting off the circulation, and thus causing asphyxia. The cord may be around the neck of the child, and so tightly constricted during labor, that the circulation is interfered with, and this also may cause asphyxia. Sometimes the differentiation of death from strangulation in this manner and from criminal attempts is very difficult. The cord may be ruptured, due to unusual shortness, or to winding of the cord about the neck or body of the child, but in this case the child died from umbilical hemorrhage. Fracture of the skull may occur during labor from pelvic deformity or from the application of forceps or to precipitate labor.

Suffocation is by far the most common means by which infanticide is accomplished. It may be produced in a manner similar to that in adults; also in other ways, as the new-born child cannot offer resistance. The face may be covered with a cloth or pillow, which will leave no characteristic marks; or the child may be suffocated by being put into a bureau drawer or box, and asphyxia gradually supervene. The child may be buried alive, in which case, if loose dirt is near the mouth or nose, it may be inspired, and found later at the postmortem examination. The child's abdomen may be compressed, either with the hands or between the thighs of the mother. Here, too, the evidence as to the manner in which suffocation was produced is rarely distinctive. More often, however, the mother attempts to suffocate the child by covering its nose and throat with her hand, thus stifling its cries. Often the marks of this method are distinct; the impression of the mother's fingernails are often seen on the face of the child around the nose and cheeks.

Often there are evidences of strangulation in addition to those of suffocation, the mother holding the child's head by a grasp around its neck. Another method which has been occasionally used is the tucking of some foreign material into the pharynx, thus shutting off the supply of air. Such a means may leave no trace, but occasionally the tampon has been found left in place. Burial alive may occur, although this is rare. If a child was buried alive the general signs of suffocation would be present, in addition to the presence of dirt in the nose and throat.

The appearance of suffocation is generally borne out by the following evidence: There is cyanosis of the skin, protrusion of the tongue, congestion of the brain, and ecchymoses under the skin and conjunctivæ. The condition of the lungs, however, is more significant, as the above are suggestive of death by asphyxia. The color of the lungs, if the child has not breathed, is not bright-red, but is dark bluish-red; the bronchi contain mucus stained with blood, which must be distinguished from the slight exudation of serum; and if the child died from bronchitis, section of the lungs and pressure upon the bronchi will give the characteristic appearance of the exudate.

Tardieu considers the subpleural and subpericardial ecchymoses and similar spots under the pericranium as characteristic of suffocation. These ecchymoses must not be confused with those of hemorrhagic diseases, such as purpura, which are irregular, large, diffuse areas of fluid blood. The subpleural ecchymoses are described as follows:

"One sees on the surface of the lungs, small, punctate spots, very regularly rounded, of a very dark red, almost black color, of which the size varies in the new-born from that of a head of a pin to that of a hemp-seed. The spots are scattered under the pleura in variable numbers, sometimes reduced to five or six, sometimes thirty or forty; in certain cases so numerous that the lungs have the appearance of granite. Sometimes they are united and agglomerated so as to give the appearance of marbling. But in all cases they are exactly circumscribed and distinct against the general background of the lungs. Their location is not less regular than their number; however, they are found most often at the root of the lung, at its base, and at the edge of the inferior border. These punctate spots are formed by little bloody effusions, little ecchymotic droplets under the pleura, arising from the rupture of the superficial vessels of the lungs. . . . I have found these subpleural ecchymoses distinct on the lungs of a new-born infant whose body had lain for ten hours in a privy. . . . Just like these found under the pleura, one finds ecchymotic spots almost constantly under the pericardium, principally at the origin of the great vessels."

Strangulation not uncommonly occurs with suffocation and fracture of the skull. If it has been done by hand, there are the marks of the

finger-nails on the neck. If by a string, cord, stocking, or some other article frequently taken from the dress of the mother, there are the signs of the constricting band on the neck, as in the adult. But the very delicate skin of the infant shows the marks of the excoriations much more clearly, although the strength necessary is only slight. Strangulation by the umbilical cord has been recorded.

The general signs of suffocation are similar to those of strangulation.

The evidence of drowning of an infant is similar to that in the adult. Water is found in the lungs and stomach and the blood is generally fluid. Where the infant is found in a privy, distinction must here be made as in drowning, between those cases where a dead child has been thrown into a vault or water, and one who has suffered death from immersion.

Death of the child has also been caused by wounds or mutilation of the body, such as may occur in adults, although, of course, the instruments used are, as a rule, of a different kind. Scissors, knives, pins, needles, etc., have been used as instruments, where they would have hardly produced fatal injury to man.

Poisoning is extremely rare. Accidental poisoning may occur in very young children and is quite common. Death may also occur from lack of proper care, either intentional or from thoughtlessness on the part of the mother or attendant. Exposure to heat or cold may cause the death of a child, although this means is seldom used, as it is too slow. Of course, where a child has been exposed to cold, bronchitis may occur, and it may die as a result of this exposure.

CHAPTER XVI.

SEXUAL DISABILITY IN THE MALE

Sexual disability is of considerable importance in legal medicine. It includes both impotence and sterility. Impotence is the incapacity for sexual intercourse, while sterility is the inability to conceive on the part of the woman or to beget on the part of the man. Both conditions apply to both sexes, although some authors restrict sterility as belonging to the woman alone; this is erroneous. A sterile person may not be impotent, but an impotent person is sterile, at least so long as the impotency persists. The law, however, does not distinguish between the two conditions.

The Massachusetts law concerning divorce is "A divorce from the bond of matrimony may be decreed for impotency of either party." Impotence has been used as a plea in defense in trials for reputed bastardy and adultery, but it is especially in divorce suits that this question arises.

Not only may this question come up in legal medicine, but it also concerns the practicing physician, as a husband or wife who desires heirs may consult him as to their sexual capacity. A mother seeks advice as to the propriety of her daughter marrying, the latter having some real or fancied malformation; a man seeks to know if he can fulfill his obligations if he marries; or a couple wish to know if they are too old to have children. It is a common practice for young men to consult disreputable quacks who advertise to "restore manhood".

Casper, speaking of this subject, says: "There is no department in forensic medicine in which such incredible lies and shameful assertions will be made to the practitioner in order to obtain a favorable opinion as in this. And very naturally, since the result in cases of pregnancy, paternity, divorce, etc., frequently affects for life the future position of the parties concerned. And, also, because the most ignorant non-professional person is conscious that in a matter that never permits any witnesses, no third party, not even a physician, can come forward either for or against him. I might fill volumes with the shameful and absurd declarations which have been brought to me. In one case a former opera-

tion on the genitals was said to have rendered impotent for a long time, a man accused of the paternity of an illegitimate child. He showed, as the still visible cicatrix of the operation, the natural raphe of the scrotum. In another case a shameless fellow had shaved all the hair from his pubes and dared to present himself as imperfectly formed and impotent."

Legal questions may arise in divorce cases where it is sought to annul the marriage contract on account of the inability of one or the other party to procreate children. This is a well-recognized principle which obtains in all civilized countries, even in China. The impotence must be established and it must be absolute and not amenable to treatment. Examination of both parties may be desirable. Divorce is sued for on this ground more often by women because it is difficult to prove the condition in women. It may be temporary; it may be permanent; it may be curable or incurable; it may be natural or accidental; it may be physical, mental or psychical.

Causes of Impotence in the Male.—The first condition that suggests itself as an incurable cause of impotence in the male is absence of the penis. This may be congenital or due to accident, disease, or surgical interference. The absence must be absolute, for cases are recorded where a small remnant of the organ has proved sufficient to accomplish fertile intercourse.

The entire absence of the testes is another cause of impotence, but the mere fact that they are not in the scrotum is not evidence that they are absolutely lacking. Where they are lacking the person shows the other genital organs imperfectly developed, and generally there is also absence of the sexual desire, and a habitus which is distinctly feminine. There is softness of the skin and the figure approaches the female type; the beard is scanty, the voice feminine, the breasts well developed, the feet and hands small, and there are other evidences of this peculiar condition.

Cryptorchids, on the other hand, usually possess the mental and physical development of the normal male. They are generally sterile, though they may not be impotent, and many authors state that they are not sterile. Monorchids may not be impotent or sterile. Atrophy of the testicles is another cause of sterility. It may result from gonorrhea, varicocele, and syphilis, mechanical injury to the spinal cord or brain, and occasionally from the use of certain drugs, such as potassium iodid. Such atrophy is permanent and not amenable to treatment.

Double castration, will, of course, cause sterility, but the removal of one of the testes does not interfere with the power to procreate. The sterility following castration is not always immediate, for the seminal vesicles may retain for a certain time the spermatozoa that

have been secreted before the operation. If it was performed after puberty, the power of erection is retained; while if performed before puberty, this power is generally lost. Even in this condition of castration there may occur more or less secretion, but this is composed chiefly of prostatic fluid or of mucus. Successful impregnation has occurred after castration, but in these cases it was accomplished soon after the loss of the testes, and was due to the spermatozoa within the seminal vesicles. Destruction of the vas deferens, whether congenital or acquired, produces sterility in males, and perhaps this is the most common cause of sterility among men.

Exstrophy of the bladder results from arrest of development of the anterior wall of the abdomen and bladder. The ureters open externally, the penis is short and imperforate and the testicles are generally within the abdominal cavity.

Certain malformations are sometimes spoken of as causing impotence, but most of them are remediable, and hence cannot be classed as true causes of impotence; for example, adhesions of the penis to the scrotum, as well as incurvation of the penis, but in either case surgical treatment will generally remedy the cause. Theoretically, a double penis may be considered to interfere, but the reverse has been proved

Taylor reports the case of a Portugese who had two organs placed side by side. The one on the right side was the smaller of the two, but both were capable of erection at the time same. The left one was the one that he used. Abnormalities in size may be remedied, and in any case may be considered as causing only relative impotence. Distortion of the penis is caused by congenital shortening of the corpus spongiosum, but this is easily remediable, as are other conditions causing a deviation in the direction of the organ. A large scrotal hernia, hydrocele, or elephantiasis may cause relative impotency.

Abnormal development of the penis may cause relative impotency, but rarely, if ever, absolute. This refers particularly to those cases of hypospadia and epispadia. Casper says: "Where the formation is otherwise, that of a normal male· hypospadia and epispadia of themselves form no basis for assuming sexual incapacity, so long as it cannot be proved in any given case that it is impossible for any seminal fluid to enter the vaginal canal." Of course, under such conditions, intercourse is only imperfectly performed, and the incapacity or impotence varies according to the amount of malformation. A moderate degree of hypospadia offers no presumption of impotence. Epispadia is rare, and, according to Casper, never occurs alone.

There are certain functional disorders of the genito-urinary system that are of more interest to the practitioner than to the medico-legal expert. A person may exhibit "atonic" impotence due to the failure

of the reflex center in the spinal cord to excite the genital organs under ordinary stimulation. It is often due to masturbation, gonorrhea, and sexual excesses. Certain drugs, especially those affecting the nervous system, such as opium, morphin, alcohol, cocain, and chloral may cause impairment, if not absence of sexual power. Certain mental stimulants, as well as the administration of arsenic or lead, may cause this same condition. A decrease and possible absence of the sexual power is symptomatic of many diseases of the nervous system, such as tabes, spinal meningitis, and also diabetes and paraplegia. Moral and subjective impotence is usually temporary and remediable. There are certain mental or emotional conditions which may produce a temporary impotence until the psychic cause is removed, such as fright, timidity, disgust, aversion, grief, disappointment, hate, etc.

In sterility in man, age has an important bearing. Ordinarily, a boy at fourteen arrives at puberty; rarely this occurs earlier, or it may be greatly delayed. Mann reports a case of a boy of thirteen capable of procreation as the youngest on record. Stone reports a case of a boy of four years. He was four feet tall and weighed seventy pounds. His muscular development was that of a man and his voice was deep. There was hair upon the pubes, the penis was flaccid, $3\frac{1}{2}$ inches long, and there were two well-developed testicles. Klose reports a case in which the father was a boy of nine years.

In the warm climates, as in India, puberty comes on at a much younger age than in temperate climates.

As age advances beyond middle life, sterility increases as the natural vigor declines, but no fixed age can be given after which a man may be considered to be sterile. Authentic cases are recorded where men have proved virile after eighty or ninety years of age. In these cases it should be stated that the age is of less consequence in forming an opinion as to the power of the person than are the habits, mode of life, and general vigor. Sterility in old age is due probably more to the defects in the excretory rather than the secretory apparatus.

CHAPTER XVII.

SEXUAL DISABILITY IN THE FEMALE

Female disability is usually considered as sterility, but here there may be impotence as well, and there may even be impotence without sterility. The subject is not of as wide application in legal medicine as it is in the case of males, because the physical causes of incapacity are more readily recognized in men.

Corresponding with the absence of the penis in the male, the absence of the vagina is not absolute indication of impotence on the part of the female.

Such a case has been reported by Burrage. "The patient was nineteen years of age, single, with a negative family history. She had never enjoyed rugged health and she had never menstruated. She became engaged to be married, and her menstrual condition led her to consult a physician as to the propriety of becoming married. Examination of the genitals revealed the following conditions: The labia, vestibule, and clitoris were well developed; the urethra was dilated; the hymen was absent. In place of the ostium vaginæ was a wrinkled area of mucous membrane, in the center of which a minute opening led to a pocket 1.5 cm. deep and lined with mucous membrane. Careful bimanual examination, and with sounds and catheters, failed to reveal the presence of uterus, ovaries, or tubes. The septum between the rectum and bladder was thin, and the organs (rectum and bladder) were normal. An operation of a plastic nature was done with the design of making an artificial vagina between the bladder and rectum. It succeeded to the extent of making a canal 2.5 cm. in diameter and 4.5 cm. deep. The girl married, and her husband two years later reported his entire satisfaction; her health had improved, and her desire for children had been gratified by adopting a baby four months old."

Even such a case as absence of the vagina may, under proper surgical operation, occasionally result in freeing the woman from impotence. An occlusion of the vagina by inflammation or a tough, resisting hymen is also usually remediable. The other irregularities and malformations in the vagina may be included in this class that are amenable to surgi-

cal treatment. But none of these conditions is absolute or calls for proceedings.

Such a case is reported by Ogston. "A woman became pregnant and in due course was attacked with what she believed was colic. Her physician, who had previously discovered her malformed vagina, presumed that her pain was due to retained menses; cutting through the septum in the direction of the supposed canal and passing his finger in he found the fetal membranes presenting. A living child was delivered. The wound was kept open and a second child was the result of another pregnancy. A minute opening into the rectum was found after the first delivery, and, by this, though it admitted a small probe only, conception was accomplished."

Further, extreme constriction of the vagina and a very small vaginal opening may cause relative impotence. Obstruction of the vagina by cancer or fibroids can generally be relieved by surgical operation and are not conditions of absolute impotency.

A peculiarly sensitive condition of the vagina, whereby, "from excessive nervous irritability of the vagina", any attempt at intercourse, or even pressure made in the vicinity, causes intolerable pain to the woman, is a condition termed vaginismus.

Gray reports three cases. In one, a woman aged 38 had been married thirteen years, but in consequence of the intolerable pain produced, her husband had not been able to have intercourse with her. An examination showed that the hymen was persistent, but the parts were so highly sensitive that a touch with the finger only produced great suffering. Nine years passed without any change in her condition. In two other cases of married women there was a similar state of the parts, the hymen being also persistent in both. One had been married four, and the other seven years, and they had had no children. The hymen was destroyed by operation, the sensibility of the parts disappeared, and one gave birth to four and the other to three children. (*Glasgow Medical Journal*, May, 1873.)

It is clear, therefore, that vaginismus would be no legal ground for divorce according to the law of England, because the defect is remediable —a fact proved by the two cases described. In the three cases the women labored under no physical malformation. They were in every respect healthy and well-formed.

Cases of Sterility due to the Inaccessibility of the Woman.—Such conditions may be caused by elephantiasis and bony deformities of the pelvis, making a separation of the thighs impossible. Taylor reports a case of flexion of the hip as the result of fracture, which caused the leg to lie transversely across the vaginal opening, but this was considered a case of relative impotency and not absolute. There are

certain psychic conditions that may cause sterility, but most of these cases are probably cases of impotence rather than sterility. Certain diseases mentioned in speaking of impotence in males may cause a temporary sterility in women, such as typhoid fever, diabetes, nephritis, pneumonia, etc.

Sterility in Women.—As in men, so also in women incapacity for procreation and reproduction is the only condition recognized by law. The question of fertility does not enter. Therefore, the condition of sterility in females is not so much one of medico-legal importance as it is of civil practice.

Certain malformations of the genital organs may lead to sterility. Uterine flexion, version, fibroid tumors, and cancer, as well as leukorrhea, gonorrhea, and menorrhagia may all influence sterility in women. Most of them are not absolute causes of sterility, but are susceptible of surgical or other treatment, and further, conception and delivery have been observed even under these conditions. At the worst, impregnation is difficult, but not impossible. Absence of the uterus, of course, establishes sterility. Disease and the congenital absence of the ovaries and Fallopian tubes may cause sterility; but here, as in similar cases involving the removal of the testicles in man, the condition may not be absolutely inconsistent with conception. Many women who never menstruate bear children. Others may continue to menstruate after the loss of both ovaries as a result of surgical operation, and delivery has occurred in women who have lost one ovary.

Age applies here, as it does in males, but the limits must not be too arbitrarily drawn. Usually the fertile period of the women is considered to be from puberty to the menopause. In temperate climates puberty may appear at about the age of fourteen, and the menopause ordinarily occurs between forty-five and fifty years of age. But there are many cases of precocious menstruation recorded. One, of a child who menstruated a few days after birth, and continued to do so at regular intervals until her death at four years of age. Other characteristics were in keeping with this. The mammæ were unusually large, the mons veneris covered with hair, and the development of the genitals considerable. Another case is reported of a girl, five years old, who had menstruated more or less irregularly since five months of age. She was very stout and fat, but not unusually tall. She exhibited other characteristics of advanced development. Another girl began to menstruate at the age of twelve months, and she was delivered of a seven pounds baby when she was eight years and ten months old. At the other end of life we meet with cases of women bearing children at sixty, and menstruating even later than this. Orfila mentions the case of a woman who began to menstruate at twenty, and continued until her ninety-ninth

year. Her first child was born when she was forty-seven years old, and her seventh and last child when she was sixty. So that it is impossible to arbitrarily limit the child-bearing age, during which menstruation may occur, but the probabilities are slight of a woman giving birth to a child after she is fifty years old. Here the same general condition of the woman, such as her habits and general vigor, must have due weight in forming an opinion as in similar cases with males.

Orfila sums up the causes of impotence and sterility in both sexes in the following words:[1]

(1) There are certain causes of impotence in both sexes, appreciable by us, which are absolute and irremediable. It is sufficient to point out the existence and character of these causes in order to prove that the individual is impotent.

(2) Certain other malformations, evident on inspection and palpation, and remediable by art, give rise to temporary impotence.

(3) Mental and moral causes are not sufficient to establish an irremediable degree of sexual incapacity.

(4) When the plea of temporary or relative impotence is set up for any reason, for instance, to meet a charge of bastardy, nothing but medical proof that the disability really existed (the evidence being established at the time of intercourse) could safely be admitted in law.

(5) Sterility can be admitted in law as a case of incurable impotence only.

(6) In every other circumstance all that we are entitled to assume amounts to mere suspicion insufficient to lead to the dissolution of a marriage or to the disinheritance of an infant.

In order to justify a decree of divorce on the grounds of impotency the impediment to intercourse or procreation must be established by competent medical evidence, and it must be apparent and irremediable. It must have existed before the marriage of the parties, and have been entirely unknown by the person suing for divorce. If it supervened after marriage it is no ground for a suit. The nature of the impediment is to be determined by private medical opinions or affidavits based on an examination of both parties, and such examination must be voluntary on the part of the man or woman. The judge of the court cannot order it against the wish of the party. All that he can do is to decide in the absence of evidence of this kind, and this may be adverse to the party refusing (Taylor). In these cases of nullity the case is generally brought by the woman against the man; rarely by the husband against the wife. The difficulty of establishing incapacity in the female, and the ease of proving physical impotence in the male, probably accounts for this difference. Suits of this nature should be instituted without

[1] Draper. *Loc. cit.*

delay, and proof must be had that the impediment was not known to the complaining party at the time of the contract. Often suits for nullity of the marriage contract are prompted many years after the marriage, and the medical jurist should always be on his guard, for many suits are undoubtedly prompted for other reasons which would not hold in a court of law, and are covered up by a charge of impotency.

CHAPTER XVIII

LEGITIMACY. PATERNITY

Occasionally we meet with cases in medico-legal practice where the actual date of birth is essential. It may be that it is not only necessary to determine the date, but even the hour and minute in order to settle the age of the person. This often occurs in its legal aspect where there is responsibility in civil contracts and also in cases where inheritance is concerned. The evidence of the physician attending the birth of the child is of variable value, according as to whether the notes made at the time were carefully kept or not. In some cases it may be impossible to obtain the evidence of the physician, due to his removal from the town in which he was practicing at the time, or he may have died in the meantime. Occasionally in such cases he may have left evidence in the way of memoranda which may be available, and it behooves all physicians to make careful written memoranda of cases attended by them.

By the English law a child that is born alive or has come wholly into the world, in a living state, may inherit and transmit to its heirs, even though it may die immediately afterward. If the child is born dead, whether within the uterine cavity or during birth, it is not considered to have been born and does not acquire civil rights.

Often the question arises—what, then, is live birth? It must manifest some signs of life after it is completely out of the parturient canal and after it is separated from its mother. The mere fact that a part of the child extrudes from the mother is not sufficient, as this might lead to the claim to the same rights as pertain to complete birth. It would also necessitate a definition as to how much of the body must be outside of the mother to constitute legal birth, and it is impossible to fix any arbitrary limit, whether the head and shoulders should be of equal importance with the foot or hand.

The act of respiration is not necessary to constitute living birth. "It is generally admitted that children may be born alive and live for some time without respiring" (Taylor).

It then becomes necessary to establish proof to show that the child was born alive, in the legal sense. The accoucheur should make careful

note of the time when the birth is completed. In cases where the birth is accomplished near midnight, care should be taken that the proper date and hour are accurately registered, as a variation of twenty-four hours may make great difference in the civil rights of the child or its heirs. In America, the child must be wholly born into the world, but respiration is not essential. It is essential that there is independent circulation from that of the mother. It is not necessary that the umbilical cord should have been cut or separated, so long as independent circulation can be established; nor is it necessary that the placenta should have been discharged. If the child breathes after being wholly born, this is an undoubted sign of its having been born alive, and this breathing is most often shown by the cry of the first inspiration; but as already mentioned, respiration is not essential to establish live birth. If present, it affords evidence that the child was born alive. If lacking, this evidence is only of negative value.

Pulsation of the heart is regarded as satisfactory proof of living, and even the slightest voluntary movement or twitching of any of the muscles has been considered sufficient legal evidence of life in England. The length of time that these signs may persist is immaterial. It is only necessary to establish that they existed once. Pulsation indicates the independent action of the fetal heart as much as does the rise and fall of the chest indicate respiration. In such cases the method to use is the stethoscope or the ear applied to the chest wall to determine the presence of the pulsating heart. One case is recorded where such pulsation was observed for twenty-three hours after the birth of the child, but unaccompanied by any signs of respiration, and postmortem examination showed that the lungs had not inspired any air. Bouchut maintains that such a condition is a morbid one of the new-born child, and that the child is living.

The first respiration, as already mentioned, is generally accompanied by a cry, which is manifest evidence of the living child, but there may be a cry uttered within the uterine cavity when the membranes are ruptured, or the child may cry during its passage through the vagina. But such evidence is not proof of live birth. A child cannot cry without breathing, though it may breathe without crying. The head may be outside the vagina and the child may cry, yet it may die before its body is wholly born, and the discovery postmortem that the child had breathed would not be conclusive of its having been born alive.

Tenancy by courtesy is an estate for life created by the act of the law. When a married woman who possesses property dies, the property passes from her husband to her heirs at law, unless there has been a living child born during the life of the wife, in which case the husband acquires a living interest in the property. This necessitates a legal

marriage. If the marriage is valid at the wife's decease the husband is entitled to his tenancy. The marriage cannot be declared void after death to affect his right. The wife must be seized of the property during the coverture, but this need not be at the time of her death nor at the time of the birth of the child. The child must be born alive, capable of inheriting the estate. The child must be born alive while the mother is also living. If the mother dies before the child is fully born, then this tenancy by courtesy does not hold, although it would be difficult to decide properly in such a case if the child lived.

Further, the child must be born capable of inheriting; that is, it must not be a monster, which, according to Lord Coke, is a being "which hath not the shape of mankind; such a being cannot be heir to, or inherit, land, although brought forth within marriage." If this principle is applied to ordinary practice, it does not constitute a monster to have deformity in any part of the body, so long as the being has "human shape", and here medical evidence may be called in to determine whether such a being is a monster or a living human being. The legal question relates to the external shape, and not to the internal arrangement. Therefore, malpositions or defects of any of the internal organs of any of the cavities do not constitute monsters. This is the opinion of the English law, but in France, if the defect is such as would be likely to cause death soon after birth, the child is not pronounced "viable", and, therefore, not capable of acquiring civil rights. But if a so-called monster is pronounced to have human shape or if it survives or is born alive, then it may inherit and transmit to heirs at law.

Maternal Impressions.—The influence of maternal impressions upon the production of deformities or upon the development of monsters is a subject that we know very little about. In many cases mothers will give explanations why their children are born with deformities, but these must be received with caution and in some cases with doubt. A mother is only too ready to give some cause for the deformity of her offspring that might be considered a reproach to herself. The subject is one that deserves the attention of medical men, especially when they receive accounts of maternal impressions before the birth of the child, and are later able to judge of any abnormality. Luff cites two cases; one by Ross, who relates the case of a married woman who had a most unconquerable desire for apples during her sixth pregnancy. She would refuse other food in preference, and would eat apples morning, noon, and night. As she was in poor circumstances she had several disputes with her husband concerning her extravagance in this direction. Several times she got into a frenzy, driving her nails into the palms of her hands until her desire was gratified. The craving was persistent from the beginning of her pregnancy until its end. When the child was

born a small pedunculated growth, about one-half inch in diameter, was found on the left hand attached to the hypothenar region at the base of the little finger. It resembled an apple in appearance, with the stem attached; there was a depression at the insertion of the stem and one on the opposite side corresponding. There was no evidence of any like deformity of the right hand. On section, the growth was found to contain a cartilaginous nucleus.

Another case is recorded by Garthright. The husband of a woman was severely burned by the explosion of a keg of powder, about the hands, arms, face, and neck. His wife was five months pregnant, and when the man was taken home, she met him calmly and without the slightest trepidation. Later she was delivered of a female child who showed the following peculiarities: the eye-brows and eye-lashes were absent; the eye-lids thickened and the conjunctivæ inflamed; its left ear, like that of its father, was doubled upon itself; on the chin was a cicatrix, and the face was covered with dark brown blisters; on the neck was a large abraded surface; the hands and arms were blistered; the left thumb was bent over the index-finger, and the other fingers over the thumb, so that the child closely resembled, in its disfigurements, the father after he had been injured by the explosion.

Limit of Age Required for Child Witnesses.—A person under twenty-one years of age is called a minor. They are frequently called upon to act as witnesses, and there is no limit from age alone at which a person may be called to testify.

A person fourteen years of age is presumed by law to have common discretion and understanding unless it appears to the contrary. Under fourteen years of age there is no such legal presumption. When a person under fourteen is offered as a witness, it is customary for the judge to inquire into the degree of the understanding of the child. If the child has sufficient natural intelligence to comprehend the nature and effect of an oath the testimony is competent. The competency of a child as a witness depends not upon its age, but upon its degree of understanding. If a child by his answers does not appear to understand the nature and obligation of an oath its testimony is not received, except in case of rape on a child under thirteen years. In one case in England it was held by the judge that at the age of seven years the law presumed that the child could not distinguish between right and wrong so as to be legally capable of crime. From seven to fourteen years of age, although the law presumes a child to be *prima facie* incapable of crime, this presumption is open to rebuttal by evidence tending to show that he had mischievous discretion. A child under seven years of age is, as had been said, presumed to be legally incapable of crime, and in the case of a child, six years old, who was arrested for stealing some wood, it

was held that the defendant was not justified, and damages were rendered against the man for arresting the boy. By law, a male of fourteen years is considered to have arrived at the years of discretion, and he is responsible for his actions; and at twenty-one years he attains his majority and is at his own disposal. A child under fourteen indicted for murder must be proved to have been conscious of the nature of the act.

A person attains by law his majority, or is of age, the first instant of the day before the twenty-first anniversary of his birthday. This method of calculation is applicable to all ages of life. It depends on the principle that a part of the day, in law, is equal to the whole day. This point has often been brought up in courts of law in respect to the responsibility of minors for civil contracts and in validity of wills. This principle of reckoning time is well illustrated in a case cited by Taylor of a man indicted for a misdemeanor in carnally knowing and abusing a female who was above the age of ten and under the age of twelve. The girl's birthday was on December 5, 1852, and the offense was alleged to have been committed December 4, 1864. The question arose whether the girl was at the time under the age of twelve. It was held by the prisoner's counsel that on December 5 the girl had entered her thirteenth year, and that she had completed her twelfth year on December 4, and that the law did not recognize the fraction of a day in such a case; that she was twelve years old on the first hour of that day as on the last hour, and it was so held by the judge. The same principle would apply in cases of rape on children under thirteen years of age and in other misdemeanors as well, so that the exact date of the birth is important, and its proof often rests with the accoucheur.

LEGITIMACY

Legitimacy is seldom decided upon medical evidence alone. The legal relations are as follows:

Every child born in wedlock is regarded *prima facie* to be legitimate; that is, to have the mother's husband for its father, unless impossibility of access or impossibility of intercourse on the husband's part can be proved.

If a husband and wife cohabited and if the slightest possible description of intercourse existed between them, the children born by the woman are regarded as the children of her lawful husband, although the woman may at the time be living in adultery.

A child is legitimate if born during wedlock although it was conceived before wedlock.

By English law a child born before wedlock is illegitimate though the parents subsequently marry.

By common law the subsequent marriage of the parents does not

render legitimate children born out of wedlock before marriage, but in many of the States the subsequent marriage of the parents legitimizes the child. This is the rule in Arkansas, Georgia, Kentucky, Massachusetts, Pennsylvania, Virginia, Indiana, Louisiana, Maryland, Texas, and New Hampshire.

Where the mother has lived and cohabited with the father and has been recognized by him as his wife and the child as his off-spring, in the absence of proof to the contrary the law presumes the issue to be legitimate, though there may be no evidence of a legal marriage between the man and the woman.

These various presumptions, however, are open to rebuttal by showing that the husband was impotent or incomptent; by showing proof of the absence of the husband during the time in which the child was begotten, or the death of the husband, or his non-access.

The normal period of gestation is from thirty-eight to forty weeks after conception. The average period is considered as about 280 days, although some authors place this as high as 290 or as low as 272. This variation is due partly to the method of calculation by reference to the cessation of the menses, but this may lead to an error of two, three, or even four weeks, as the actual time of conception cannot be determined. The popular idea that the time of conception may be determined by signs on the part of the woman is a popular fallacy without any good grounds for its acceptance. As a rule, it is pure conjecture on the part of the parents as to when conception took place. If, on the other hand, there has been but one intercourse, the duration of pregnancy can easily be calculated. But even here there may be wide divergence, as is reported by one author of three cases where labor came on in 260, 264, and 276 days; and another author cites a case of 293 days after a single intercourse. But a comparison of this latter case with the one first mentioned shows a difference of thirty-three days in calculating the normal period of gestation.

Many authors have published various views on this subject, and it is impossible to fix any definite limits for the period of gestation. Further, it may be that the time of conception often following a single intercourse varies in different women, and this may be due to the variation in the location of the ovum at the time of intercourse. The time at which the woman may become pregnant in respect to the menstrual flow is a question that has been widely discussed; there is no doubt but what conception may take place before the appearance of the menses; also that it may take place following the menses, even after signs of menstruation have disappeared, and there is no fact to disprove the opinion that the human female is susceptible of impregnation at any time between her menstrual periods. One author states that impregnation is more

likely to occur immediately after the termination of the flow than at any other time. The next most probable period is immediately previous to the appearance of the flow, and the probability of conception becomes less as the interval increases from this period; but in several cases of single intercourse, conception has been known to take place twelve or even fourteen days after menstruation, so that the time of conception cannot be fixed by the time of intercourse. By some authors it is maintained that the spermatozoa may retain their power for as long as seven days within the female body, but this does not explain many cases of prolonged gestation, and, therefore, we must admit that either the conception is delayed for long periods or that the period of gestation may be prolonged for a considerable period beyond the usual forty weeks.

A birth occurring before the thirty-second week of gestation is considered premature, and those which occur after the fortieth week are considered protracted; and it is important for the medical expert to determine whether the characteristics presented by the child agree with those which should be present, supposing it to be legitimately born.

Children born after prolonged or protracted gestation are not necessarily more developed than those who are born at the end of the usual term of pregnancy. In judging of the development of a child as a test of its uterine age, allowance must be made for the various exceptions which are liable to occur. Although the characteristics of the seven months child are usually well-marked and may be well understood, it is not possible to distinguish absolutely between a child born at the eighth month and one born at the ninth.

A child may have grown to its natural size and gestation be completed in less than nine months, but if a child is mature when it should be six months in order to be the offspring of the husband, then it is easily determined to be illegitimate. But the size and weight alone of a seven-months, or even of an eight-months child, cannot be considered proof of the illegitimacy of a child born at term. The wide variation in size and weight of a full-term child is well known. In addition to these, there is a general appearance of full development, which, however, may be lacking in a child born in less than nine months. During the last two months of intra-uterine life the child develops rapidly, much more so than during an equal period at any other time.

Taylor cites a case where the question of premature development arose incidentally upon an alleged gestation of 259 days. The intercourse took place on November 9, and the child was born on July 26 the following year, a period of 259 days or thirty-seven weeks. The child was apparently a mature child. The counsel for the defendant admitted that a child born at this period—that is, three weeks before maturity—

might be as large as one born at full term, but he denied that it would be so perfectly developed. Another witness said that the full size was generally combined with full development, and he stated that it was against all the laws of nature that a child should be born fully developed a fortnight before the usual term of gestation, which he considered as nine months and a week. Therefore, if there had been intercourse on November 9, the date of probable delivery would be a week after the ninth of the following August—that is, August 16, further, as the child was born in mature state on July 26, which was three weeks before the usual term, therefore, in his opinion, impregnation had probably taken place from some other person three weeks earlier than the period assigned by the woman. The same witness considered it to be as rare that a child should be born, full-grown, three weeks before the usual period as that a man should attain one hundred years of age.

But there are few medical witnesses to-day who would care to affirm such an opinion or to call a child a bastard or convict a woman of adultery on the ground that the child showed the usual appearances of maturity after 259 days' gestation. If we adhere too strongly to this idea of mature development, there is a chance of being mistaken, for it might happen that a child born at the end of nine months who showed extraordinary development in size and weight might, if it had been born at seven months, have shown the normal development and the usual size and weight of a full-term child.

Viability.—The English law does not require that a child, when born, shall be capable of living, or viable, in order to take its civil rights. So that it may be born at an early period of gestation, and whether the child was mature or immature does not concern us here, although it is well known that under a certain age children are not born living, or if living, they soon die. The earliest period at which a healthy child can be born living is a subject for medical evidence. It is universally admitted that children born at the seventh month of pregnancy are viable, although they are more delicate than those born at full term. They may be born alive at any period between the sixth and seventh month, and even earlier than this, but this is rare, and if they are born alive they generally die speedily. One case is recorded of a child being born viable as early as the fourth month, and another in which a woman aborted at the fourth month and a half of her pregnancy. In this case the child died about six hours after its birth, although it manifested regular respiratory movements. In another case a child was born at five months and a half gestation; it cried immediately after birth and continued to cry as loudly as a full-term child. It lived forty-four hours. It passed meconium, but did not urinate; it could swallow without difficulty, its eye-lids were closed, and it weighed about 1½ pounds. There are

many other cases on record where children have been born during the fifth month of gestation, and have survived for greater or shorter periods of time. One case is recorded of a child born 158 days after intercourse. It weighed one pound, and was eleven inches in length; its development was far from being mature, and yet at three and a half years it was healthy, but of small size, weighing only 29½ pounds. So that it is established that children born at or about the sixth month may be reared and their survival cannot be taken as proof of illegitimacy.

Luff says: "From the cases that have been mentioned the following conclusions may be drawn: 1. That a fetus born at an earlier period than the fourth month of intra-uterine existence cannot be said to be born alive. 2. That a child has been born viable 158 days after intercourse, but that such a case is very exceptional, and that the great majority of infants born at that period would not be viable. 3. That in would be unjust to brand a child with illegitimacy or its mother with want of chastity, because a six months' child is born alive and viable."

Prolonged gestation has given rise to considerable discussion; that it may be prolonged beyond forty weeks is not doubted. Here full allowance must be made for calculating the exact period of gestation; that is, allowance must be made for determining the date of conception; and if we calculate from the last date of the previous menstrual period we should deduct at least twenty-eight days. But it should be borne in mind that a woman may occasionally menstruate after conception has taken place, not only once, but several times. One case is recorded of protracted gestation lasting to 330 days. But we cannot admit that all of the protracted cases recorded have been owing to mistakes in calculation. Either the average term of pregnancy is wrongly calculated at the thirty-eighth or fortieth week or it is rightly calculated to occasionally extend to the forty-fourth or even to the forty-sixth week. There appears to be no valid reason why the variation should not be considered, and why, if the pregnancy occasionally lasts to nearly 300 days, it should not last beyond 300 days. It is impossible to reconcile all the conflicting medical opinions upon this subject of the duration of pregnancy. The best we can say is that the period cannot be limited to a fixed and invariable number of days or weeks, but that it is liable to variation according to circumstances not fully understood (Taylor).

The period of gestation has not been fixed by law. Each case rests upon the opinion of selected medical witnesses and is decided upon its own merits. In the United States the decision in favor of legitimacy has been made where the gestation extended to forty-five weeks and two days.

PATERNITY

The question of paternity arises in connection with cases of bastard children where the reputed father is called upon to support the child or where the child, although claiming to be heir to an estate, is alleged to be supposititious. This question also arises where a widow marries a month after the death of her first husband, and the child is born from nine to ten months later. Although paternity is generally determined by other than medical evidence, still there are certain facts determined by the medical evidence that may have a bearing on the case.

Likeness to the father, not only in feature, but in voice, manner, attitude, gesture, and other personal peculiarities which characterize the alleged parent may be regarded as corroborative evidence.

In a celebrated case in England involving the Douglas Peerage, where two brothers claimed the inheritance, but were refused as being supposititious children, Lord Mansfield made the following remarks: "I have always considered likeness as an argument of a child being the son of a parent, and the rather as a distinction between individuals in the human species is more discernible than among animals. A man may survey ten thousand people before he sees two faces exactly alike, and in an army of one hundred thousand men every man may be known from another. If there should be a likeness of feature, there may be a difference in the voice, gesture, or other characters, whereas a family likeness runs generally through all of these; for in everything there is a resemblance, as of feature, voice, attitude, and action" (Taylor).

In this case the evidence was not derived from medical witnesses only. It was furnished by friends and relatives who had known the parties and who were competent to speak of the facts from personal acquaintance. Therefore it would hardly be considered within the province of medical jurisprudence.

Parental likeness may be occasionally manifested by color or peculiarities belonging to the various races of mankind. In such case the evidence becomes much stronger; and, supposing that two men of such different characteristics had intercourse with the same woman at about the same time, the color of the skin of the offspring might enable the court to determine the question of paternity. The color of the hair has in certain instances been offered as evidence to fix the paternity of the child, but such evidence is far less conclusive than that afforded by the color of the skin. Taylor reports a case where it was alleged by the husband that his wife had had criminal intercourse with another man. The woman had had children by her lawful husband, and the hair of the parents, as well as of the children, was dark. The child alleged to be illegitimate had red hair, and the man alleged to be the father had red

whiskers and sandy hair. But such evidence is not conclusive, as red-haired children are often born to parents having dark hair.

Medical questions may arise where it is alleged that a man is the father of a particular child, and here the defense is that certain circumstances render it impossible. Such circumstances may be the presence of gonorrhea or syphilis in the man, and he may have been under medical treatment at the time for his disease. It cannot be maintained that such diseases are invariably transmitted by intercourse or that they interfere in all cases with procreation. When two men have intercourse with the same woman on the same day the question of paternity can only be settled by the accident of likeness between the child and one of the men. In most cases of bastardy medical evidence is rejected, chiefly on account of its indefiniteness.

In these cases of doubtful paternity or affiliation, the place of birth is to be given precedence over the place where intercourse, or even conception, took place in matters involving jurisdiction.

Posthumous Children.—A widow marrying immediately after the death of her first husband might give birth in nine or ten months to a child. There would be no question as to the legitimacy of the child, although its paternity might be doubtful. By immediate, is meant within a short period, such as six weeks, for if it was longer than that the presumption would be that the child was of the second husband. Fortunately, such speedy marriages are not customary in society, so that such cases are very rare, and the presumption would fix the paternity upon the second husband, unless it could be proved that he did not have access. The mere similarity in likeness of the child to the first husband in such a case would not be sufficient to combat the legal presumption.

Superfetation.—By superfetation is meant a second conception taking place in a woman already pregnant. The two children might be born during the same delivery, though differing considerably in their maturity; or the two children might be born at different times, each mature. Certain authors regard superfetation as impossible; others admit its possibility. Where a woman possesses a double uterus, superfetation is possible. Reese maintains that superfetation is established by the fact that a woman may give birth to two children of different colors, and by her admitting that she had intercourse with a white man and a black man. After conception has taken place, the os uteri is not completely closed until the united membranes interpose a barrier between the ovum and the semen. Most of the cases of superfetation, however, can be explained on other grounds. It is possible in a twin pregnancy that one fetus may develop at a greater rate than the other, and, granting the supposition of many obstetricians, that the maturity of the fetus is the exciting cause of labor, one child might be born at full

term on account of its maturity, and the other child be born at a later period, when it reaches its maturity; granting in this case that the second child experienced protracted gestation. Exceptional cases, however, may occur which cannot be explained on this supposition, and which are probably due to two successive conceptions. In such cases the question of the legitimacy of the second child may be doubtful, for it may have been born at a period of such prolonged gestation that the husband may have died, or he may claim that he did not have access. In these cases the legitimacy would depend upon other grounds. The proof of such superfetation of itself is no evidence of the child's illegitimacy.

After delivery it has been supposed that an impregnation would not take place until the organs had resumed their natural condition, but according to Bonnar impregnation may take place as early as the fourteenth day after delivery, so that a woman may be delivered in scarcely nine months after a previous delivery, but any question of legitimacy arising therefrom would depend upon other than medical evidence.

Supposititious Children.—A woman may feign delivery and represent the child of another woman as her own offspring. Or she may substitute the living child of another woman for her dead child, or a male child for a female. Such frauds may seriously affect the civil rights of the child, but, as at least one accomplice is necessary to perpetrate such a fraud, it is rarely accomplished, and cannot be done without great dexterity and cunning. Usually medical inspection will expose the deceit.

Wharton and Stillé cite a remarkable case where such an imposture was attempted. "Dr. Albert relates that he was called upon to see a poor girl of twenty-one years of age in her last illness. In the presence of the physician and the clergyman of the district she gave the following narrative and confession. Some eighteen months previously she entered the service of a married couple as housemaid. Her master, who was young and handsome and assumed the title of baron, had no children. He succeeded by tempting presents in overcoming her virtue. He then represented to her that an important inheritance depended upon his having an heir, but having been married five years, and his wife still proving unfruitful, he had no longer any hope of having children by her. He then proposed to the girl that in case she would prove with child, and would allow him to cause it to appear as his own legitimate offspring, he would not only give her a considerable sum of money, but would also let her remain in the house of her mistress, in order that she might be always near her child. She accepted the proposal, and as soon as she found herself to be pregnant the preparations were made to carry out the projected imposture. The girl remained in the house, living in the most retired manner, while her mistress played the part of a lady in an

interesting condition. She introduced wool and folded napkins under her dress, and thus gradually let her rotundity become apparent, rubbed her breasts frequently, in order to develop them, fainted in church, was often ailing, and sent for midwives and consulted them concerning her symptoms; physicians were also called upon, and every means taken to make public her happy expectations, so that no one had any suspicion that she was not pregnant. The traces of her monthly sickness were carefully concealed.

"At last, in due time, the young girl fell in labor, which was allowed to advance considerably before the midwife was sent for. In the meantime the bed was arranged in the following manner: A board was taken out of the bottom of the bedstead, and immediately above this opening, a hole was made through the mattress and paillasse, large enough to allow the legs of a person to pass through and rest upon the floor. The bed was made in such a manner as to sink down toward the headboard, while it was elevated below the opening in the mattress. The mistress now leaned in a sitting position, with her legs through the opening in the bed, and supported against the headboard, while the servant lay across her lap on a feather bed in the attitude of labor. Her body was entirely concealed by the bed-coverings, which also concealed her mistress up to the neck. The midwife, upon her arrival, found the baroness, as she supposed, in the throes of labor; she made the necessary examination, promised a speedy deliverance, and gave the usual words of comfort. The lady, however, screamed lustily at every pain, the approach of which she became conscious of by the involuntary contractions of the poor girl's body; while the latter suppressed her cries as much as possible, except when she could mingle them unperceived with those of her mistress. A living male child was soon born, and the after-birth followed it immediately. While the nurse was busy in washing and dressing the child in another room, the girl escaped from the bed into an adjoining chamber. The baroness, before the return of the midwife, drew her feet up from the opening, covered it over with the bed, and stretching herself out upon it, forbade the midwife (who was desirous of ascertaining her condition) to touch her, except to wash off the blood with which she had previously soiled her thighs, declaring that she was in so much pain that she could not endure the slightest touch. The child was baptized and on the second day put to the breast of the lady. As, however, very naturally, it found nothing there, the midwife was discharged, on the pretext that the baroness's own attendant could now take care of the child, which, immediately upon her departure, was confided to its own mother. The remainder of the girl's history, not being essential here, is omitted. Unexplained circumstances prevented the fraud from succeeding. The authors of this conspiracy fled, leaving the servant girl

sick and in a state of destitution. She died from the effects of privation and exposure shortly after having made this confession."

We may be further concerned by the question of legitimacy where one of the parents is reputed to have sexual abnormality. The male may be impotent, or even sterile, as well as the female, and if any of these conditions can be proved the illegitimacy of the child is established.

CHAPTER XIX.

MALPRACTICE

Malpractice may be defined as the negligent or unskillful performance on the part of a physician or surgeon of those duties which are incumbent upon him by reason of his relations with patients, or the lack of proper care, skill, diligence, or judgment that the law requires in the performance of a professional act. We may divide this subject under two headings, civil and criminal malpractice.

An action for civil malpractice is generally based upon negligence, and the physician is liable to the patient for injury suffered by him, resulting from lack of ordinary skill or from negligence in applying that skill. In most States the rule of law is that a physician should practice his profession with a degree of skill and diligence such as those "thoroughly educated in his profession ordinarily employ". In general, it may be said that the practitioner must possess at least an average degree of learning and skill in his profession that exists in the place where he practices.

A physician is not liable for the results of carelessness of others, unless his own carelessness contributed to the injury. Nor is he responsible for injuries caused by improper treatment by another acting in his stead.

Injuries caused by want of proper care or skill can only be recovered for from a physician where the patient exercises no negligence that contributed to the result. If in case of injury or disease persons in charge of the patient do not follow directions and thereby contribute to the injury, no action can be maintained against the physician. There is a general rule that a patient may recover, notwithstanding his own negligence, where the negligence of the physician was the original cause of the injury, even though the injury was aggravated by improper treatment by those in charge of the patient. If the negligence of the physician can be separated from that of the patient, then the physician may be sued for such injury as resulted from his own negligence.

The burden of proof rests with the plaintiff in an action for malpractice against a physician. If negligence or want of skill on the part of the physician is claimed, it must be so alleged and proved. Further, the plaintiff

in an action for malpractice must show his freedom from negligence contributing to the result on which the claim is brought.

A mistake in judgment by a physician in the remedies or appliances selected does not render him criminally liable, and if a physician prescribes for a patient, acting honestly and with the intention of curing him, he is not criminally responsible for an unfavorable result. To render a physician criminally responsible it must appear that he was acting with wicked or evil purpose or that his neglect was willful or criminal. A person having no medical education who prescribes the use of a dangerous medicine when proper medical assistance could be obtained, does so at his own peril, and if death ensues he is guilty of manslaughter.

In an action for malpractice the burden of proof is upon the plaintiff to show that the defendant did not exercise proper skill, care, or diligence, and that the plaintiff's injury occurred as a result. The mere fact that the plaintiff was not cured by the defendant is no presumption of the lack of proper care, skill, or diligence. This skill, care, and diligence is beholden not only upon a regular practicing physician, but upon one who holds himself out as such. (See Regular Physicians.) The employment of a physician does not imply that a cure will be effected, and no action for failure to cure can be maintained, although the physician may agree to the reverse, namely, no cure, no pay. Once having undertaken a case, a physician is bound to continue his services until a reasonable time has been given the patient to procure another physician. This applies to services that are gratituous as well as to those that are paid for by regular fees. No physician is required to assume charge of a case, for the State license to practice does not imply that the physician is compelled to do so. A physician is responsible only for reasonable care and judgment. He is not responsible for mere errors of judgment, or mere mistakes in matters of doubt and uncertainty, but if the error of judgment is so gross that it is inconsistent with the degree of skill ordinarily required by law, then the physician is liable for action of malpractice. A physician has no right to try experiments upon his patients, which result in their injury, unless previous permission has been obtained from them.

Those practicing according to one particular school of medicine must adhere to it and must exercise the degree of skill ordinarily used by those practicing in that school.

The exhibition of a sign or other proof that one holds himself out as a physician to practice medicine or surgery is *prima facie* evidence of his professional character, and the possession of a medical diploma of good and regular standing is *prima facie* evidence that its owner is possessed of the ordinary skill.

The refusal of the plaintiff in an action for malpractice to submit to

an examination by physicians of his injury is within his rights, but the refusal for such examination is generally considered presumptive of false claim; but, as mentioned under Rape and elsewhere, the plaintiff cannot, be compelled to submit to an examination, and any attempt on the part of the physician to make such an examination may offer cause for an action of assault.

The patient may exercise his own judgment as to the advisability of surgical operation, but here the physician cannot be held accountable for injury resulting therefrom, provided that the physician used ordinary skill and care. Where a patient can be saved only by a dangerous operation, or where the intelligent consent of the patient to such an operation is unnecessary, and where it is then skillfully performed, the physician cannot be held accountable, even though the patient dies.

The burden of proof is upon the plaintiff that the patient did not consent to the operation.

Where the practice of medicine is regulated by statutes in the various States an unlicensed practitioner cannot sue for services, but he is liable for an action of malpractice.

Physicians and surgeons should keep up with the latest advances in medical science, using the latest and most approved methods and appliances having in view the general practice of the profession in the locality where he practices, and it is a question for the jury whether the physician or surgeon has done his duty in this respect. If the patient contributes to the injury by his own fault or negligence, he cannot recover for malpractice. A suit may lie where pain and suffering are caused by negligence or want of skill as well as for the loss of time or expense incurred on account of improper treatment.

CHAPTER XX.

CORONERS' INQUESTS

The system known as "Coroner's Inquest" is in use in most of the States. Another system known as the Medical Referee Law or the Medical Examiner Law, which is in use in the States of Massachusetts, New Hampshire, and Rhode Island, is in many respects superior to the coroner system. The coroners' act as established in England is the basis of similar acts in the United States. It directs that "Where the coroner is informed that the dead body of a person is lying within his jurisdiction, and that there is reasonable cause to suspect that such person has died either a violent or unnatural death, or has died a sudden death the cause of which is unknown, or that such a person has died in prison, or in such place or under such circumstances as to require an inquest in pursuance of any act, the coroner, whether the cause of death arose within his jurisdiction or not, shall, as soon as practicable issue his warrant" for an inquest. The attention of the coroner may be directed to a sudden death by the physician last attending the deceased, or where the physician in attendance makes an unsatisfactory return of death to the board of health, or where the district attorney considers that there are suspicious circumstances requiring further explanation.

In Massachusetts and other States, where the coroner's system is not used, the medical examiner, after being authorized in writing by the district attorney, mayor, or selectmen of the district, city or town, in which such body lies, shall make an autopsy in the presence of two or more persons whom he may compel to attend by subpœna. One of these witnesses may be a physician, if considered necessary by the medical examiner. The medical examiner's report is then filed with the district attorney. If the medical examiner considers that death was caused by violence he shall at once notify the district attorney and justice of the police, district or municipal court or trial justice having jurisdiction over the place in which the body was found. The court or trial justice shall thereupon hold an inquest. The district attorney or some person designated by him may attend the inquest and examine the witnesses. The attorney general or the district attorney may direct an inquest to be held

in the case of any casualty. Where an inquest is held, witnesses may be summoned by an officer appointed by the court. After the inquest the magistrate shall make his report and file it in the superior court of the county in which the inquest is held. The magistrate may further bind over such witnesses as he considers necessary, or as the district attorney may designate. The attorney general or the district attorney may direct an inquest to be held, even though the medical examiner reported that death was not caused by violence.

Where the coroner's system is in vogue, the usual procedure is somewhat as follows: The coroner is appointed by the judges of the superior court, as a rule, and there may or may not be appointed by the coroner a medical examiner. Where there is a medical examiner appointed by the coroner, and a person comes to a sudden or violent death, or where a person is found dead, the manner of whose death is not known, anyone who becomes aware of such death shall report the same to the said medical examiner, and the medical examiner without delay shall view the body and take charge of it. Where the medical examiner is satisfied that death was not caused by criminal act, etc., he shall make a return of the death certificate, and shall report to the coroner to that effect. But where the medical examiner suspects that the person whose body he has viewed came to his death by the criminal act of another, he shall immediately notify the coroner of such death and where the dead body is. The coroner shall immediately proceed to view and take charge of the body, and if he believes that death was caused by criminal act, he may order an examination or autopsy to be made by the medical examiner or some other competent physician. The coroner may also cause a jury to be summoned before him to assist in his investigation. The coroner then communicates the verdict or finding to the prosecuting attorney of the town or city in which the death occurred, and makes a return of the inquest in writing to the clerk of the superior court.

The coroner can enter any and all places in his county and is empowered to issue a warrant for a jury of inquest, to compel the attendance and testimony of witnesses, and to punish for contempt to the same extent as justices of the peace. Processes, orders and papers proper in a case may be issued by a coroner.

Every witness must obey a subpœna, but need not attend a trial or inquest except upon a subpœna or when bound over. Payment of fees may be demanded before testifying and every citizen is bound to obey such calls as to facts within his knowledge. If the witness knows any question of fact, he may be compelled to attend, but he cannot be compelled to give his attendance to speak on matters of opinion only. This brings out the difference between the ordinary and skilled or expert medical witness. "The former is bound as a matter of public duty to

speak to a fact which happens to have fallen within his own knowledge, while the latter is under no such obligation." It is not always easy to distinguish between fact and opinion, and in medicine particularly it is difficult to separate the two. Rarely can a physician avoid giving an opinion arising out of the medical or scientific fact. (See Chapters XXII and XXIII.)

CHAPTER XXI.

INSURANCE

A life insurance policy is a contract which the insurer undertakes, in consideration of a certain sum of money, called a premium, to pay to the party for whose benefit the insurance is taken, a certain sum of money when the insured dies or attains a certain age. The premium may be paid in one lump sum or it may be paid at certain periods, yearly or oftener, and the amount of the premium is dependent upon the age, sex, trade, health, and other circumstances of the insured, and in some cases also upon the age, sex, etc., of the party for whose benefit the insurance is taken.

Where the insurance is upon the life of a person it cannot be recovered until distinct proof of the death of that person is proved. Where there is any doubt, the death must be proved by those for whose benefit the insurance was taken out. Where insurance money has been paid after the supposed death of the insured, and it is later proved that the insured is alive, money that has been paid out must be refunded to the insurance company, and they are entitled to sue. This is not of rare occurrence.

The most important condition in the issuing of a policy for life insurance is the general state of the health of the insured, and it is here that the testimony of a medical witness is of importance.

As in other contracts, here the law requires there should be strict compliance with the conditions by each party. The practice of "passing" an applicant for life insurance upon a certificate of the applicant's physician is one that is seldom, if ever, used at the present day. Generally, the examination is made by a duly authorized medical inspector or medical examiner connected with the insurance company.

The examining physician is the agent of the company, and not of the applicant for insurance, so where the certificate from the company's physician shows the applicant to have been in good health, it is competent evidence of that fact. The medical examiner is not an agent for the company with reference to the application for insurance, and where he fills out the entire application, including more than the strictly medical part, the company is not responsible and the policy is void, except where

such medical examiner has received application blanks from an authorized agent. The applicant is not required to see that the answers given by him are those written down by the medical examiner, but if he knows his answers are incorrectly recorded, he must report the proper corrections to the company, otherwise he is held responsible for their effect upon the validity of his policy.

The usual medical attendant of the insured is the only individual who can properly certify to the state of the previous health of the applicant, but this is a custom which is open to very serious objection. The insurance company should not have the right to require a certificate from the physician, whereby the physician is exposed to the risk of losing the applicant as his private patient if he gives an unfavorable opinion, and the physician should in all cases feel himself bound to render a conscientious and true opinion. It is much better for the regular physician of the applicant to decline to furnish such a certificate.

Important questions may arise where the opinion of a medical expert is required, where there is alleged infringement of the conditions of the policy. One of the most common is under the heading of disease tending to shorten life. It is impossible to determine what diseases do and what diseases do not have a tendency to shorten life. While any deviation from health might be so considered, the law limits the meaning of the word, considering that it applies to those diseases only which, from the medical point of view, are regarded as of a serious nature, and generally are likely either directly or indirectly to affect the duration of life of the person suffering from them. Such diseases are not only those which run a rapid and fatal course, as tuberculosis and cancer, but may include gout, rheumatism, insanity, or even chronic diseases. The disease itself may not actually be present, but the applicant may show a well-marked tendency toward one of them, and in such cases the policy is void. The question is not whether such diseases are necessarily fatal, but rather whether their tendency is to shorten life; and if this can be established by medical evidence, then the policy is void.

The question of habits is also an important one for the medical witness. The habits may be such that they of themselves tend to shorten life, or to produce injury to the general health, and the concealment of such habits may affect the validity of the policy as much as does the concealment of disease. Habits of intemperance, opium eating, or morphinism, and excessive use of tobacco may materially affect the validity.

The signing of health certificates by practitioners is a practice that is open to objections. Many maintain that if the applicant is in good health at the time he makes application that is sufficient so far as the company is concerned, and an applicant after an attack of sickness will

often apply to another physician for a medical certificate. Such a practice is not to be encouraged as it may lead to the perpetration of a fraud. Where the applicant has suffered from some trivial illness which is not likely to affect the risk, he should state it as well as in those cases that are of a more serious nature, and which are clearly pertinent to the question. In doing so he is acting in good faith toward the company, and the question whether they are material or not may then be decided by the jury.

If the jury find that the concealment is material by law, the policy is void, and it is not necessary in this connection that the disease concealed shall be the ultimate cause of the death of the insured. This rule was laid down by Lord Tenterden in the case of one Colonel Lyons. The insured took out two policies on his life in May and June, and died the following October. The companies refused payment on the ground of misrepresentation and concealment. The company was referred for a certificate of the insured's health to a practitioner who had not attended him for three years previously, and who said in answer to the printed questions that he had no other medical attendant, and that he had never had a "serious illness". The physician to whom he referred said that his life was insurable and the policy was issued. It appeared later, however, on evidence, that the colonel had been attended by two other medical men between February and April for hepatitis and fever, and one of these physicians considered Lyons to be seriously sick, and would not have certified that he regained his health until the end of May. It was mutually agreed by all that Lyons did not die of the disease for which he had been attended during this time, but Lord Tenterden held that if one referred to a certain physician because the latter could speak favorably of his health, and thought that if he referred to the other physician he would not speak favorably, that although the insured did not die of the disease with which he was then afflicted, the policy was void.

The practice of referring to a medical man who has only recently been consulted by the applicant is not infrequent, and this often leads to a lack of fair dealing, and commonly defeats its own object, for the policy may be contested and judged void.

Intemperance.—Often the payment of policies is held up on the ground of concealed drunkenness or general habits of intemperance. Although medical men may vary in their opinions respecting the effects of such habits upon the general health, still they should, if the habits are known to them, state that they exist, so that the company may not be in a position to later contest the policy. Although people vary greatly in their susceptibility to the effects of alcohol, yet probably all are more or less injured by it. A good constitution may enable a man to resist the

pernicious effects for a longer time than one who is weakly. As death in such cases is called "natural", there may be no postmortem examination to show the condition of the liver or other organs, which might be valuable evidence in deciding the contested policy. Here the company who refuses payment of the policy is at a disadvantage, for it is bound to prove what they allege by conclusive and satisfactory evidence. It is not sufficient to say that a particular disease or habit probably existed at the time of the issuing of the policy; and even if the habits are shown to have certainly existed, the evidence may still be insufficient to prove satisfactorily that the concealment was willful or material.

Morphinism.—This habit in the insured may cause the company to resist payment of a policy on the ground that it is a habit tending to shorten life. An important case is cited by Taylor.

The Earl of Mar insured his life, and two years later died of jaundice and dropsy, at the age of 57. The insurance company refused to pay the policy on the ground that the Earl was at the time of the insurance, and had been for some time previously, an opium eater. The habit had been concealed from the company and it was further alleged that the habit tended to shorten life. It was proved that the Earl had been a confirmed opium eater up to the time of his death. Many of his friends and those about him testified that until the year of insurance he was of a cheerful disposition and had a clear intellect. The main question at the trial was whether opium eating tended to shorten life, and whether concealment of this habit from the company was or was not material. Many experts were called by the company, and although they entertained the opinion that the habit did tend to shorten life they were unable to support their opinion by facts. Their opinions were based not on personal experiences, but upon the general effects produced by opium upon the system. In most of the cases that were collected there was no evidence that life had been shortened by the practice, and on the other hand, some persons had carried it on for years, and had attained a good old age. A verdict was given by the jury in favor of the plaintiff, and on the ground not so much that the practice was innocuous and concealment immaterial, as upon the technical point that the company had not made the usual and careful inquiries into the habits of the Earl. It appeared that the general question with respect to the habits of the deceased had not been answered by the medical referee, and it was considered that the company had waived this question, and that they had therefore taken upon themselves the risk from their own carelessness. A new trial was granted, but the suit was compromised.

This habit of morphinism is an important one, but there are no decisions so far as it affects the life insurance policy. Christison collected from numerous sources twenty-five cases where opium had been

taken in large quantities for forty years without producing any marked injury to the health, and in the case of the Earl of Mar it appeared that he had indulged in the habit for thirty years, and no injurious effects had followed until the last two years. There is no doubt that morphinism does affect the general health injuriously, and it may be reasoned from this that it tends to shorten life. In any case, however, the company should be informed of the habit, where it exists in the applicant, so that if a policy is issued it cannot be contested by the company later, and possibly be made void. Where a company resists payment of a policy on the ground of concealment of the habit of morphinism and the case is left to the jury, there may be other circumstances to be considered. A person of good constitution who had enjoyed good health, although practicing this habit for many years, might not be considered to have been seriously injured by it, and the concealment of the habit might not be material.

Tobacco.—The excessive use of tobacco predisposes to dyspepsia and loss of muscular and nervous power, but there is no evidence that the habit has a tendency to shorten life. Where the applicant is an inveterate user of tobacco this should be mentioned in the application, so that no ground may exist for the contesting of the policy by the company.

Insanity.—The concealment of insanity in any of its forms or even the concealment of a known hereditary tendency is considered material so far as the validity of the policy is concerned. The popular idea that the insane people live longer than the sane is erroneous. The insane are more liable to epilepsy and paralysis, and also to various other diseases, and when so attacked withstand the disease less well than the sane, hence the mortality of the insane is higher, other things being equal.

Suicide.—Most insurance policies carry a so-called "suicide clause" whereby the policy shall be void if the person who insures his life commits suicide. This clause in most policies holds for suicides occuring within two years after the policy is taken out; in a few cases in one year, and in a few cases for all of the time while the insurance is in force. Where the "suicide clause" holds for one or two years, as the case may be, it is presumed that suicide occurring after that time is not committed with reference to the original application for insurance. In these cases a person can willfully commit suicide without making void the policy, but where the "suicide clause" holds during the life of the policy, then, of course, this does not apply.

In case of sudden or violent death occurring within the limit of the time allowed by the "suicide clause", there may arise the question of suicide. Such cases of violent death are often investigated by the medical examiner or medical inspector or coroner, according to the system prevalent in the State where the death occurs, with a view only

to determining whether the death was accidental, homicidal, or suicidal, without reference to the bearing it may have upon the life insurance. In these cases this question may become of great importance, and it may be necessary for the plaintiffs, those benefiting by the policy, to show clearly that the insured met his death by accident or homicide, without any suspicion of suicide, before the company is compelled to pay the policy. Therefore the cause of death should be determined as accurately as possible. If there are any suspicious circumstances attending the case, a civil action may follow, and the company may refuse payment until compelled to do so by law.

An interesting case of this kind occurred in Massachusetts in May, 1903. Edwin M. Thayer resided in Newtonville, Mass., and up to about a year previously was employed as a clerk in a large insurance office. Thayer was arrested by a police inspector, charged with uttering a false mortgage for $5,000, and when the case was called in court it was continued until April 12. He passed the night of April 30, at the Hotel Lenox, in bed with a constable who was sleeping beside him. The next morning he was found dead in bed. He had been ailing, meanwhile, and had been attended by friends and relatives.

Medical Examiner Draper certified nephritis, complicated with a cardiac affection and congestion of the lungs, as the cause of death, after he had performed an autopsy on the body. Suspicion arose on the part of some of the life insurance companies, and an order for exhumation was issued by the district attorney. The investigation into the circumstances of Thayer's death became a case in the criminal courts of Suffolk County, on the ground that, by common law, suicide is a crime against the State, as it deprives the Commonwealth of one capable of performing military duty.

New York makes suicide a criminal offense; but, as in Massachusetts, it is held as being against the common law.

The body was exhumed under the supervision of Medical Examiner Draper and portions of the organs desired were submitted to Prof. W. B. Hills, Prof. Charles Harrington, and Prof. E. S. Wood, all connected with the Harvard Medical School.

Prof. Hills and Prof. Harrington reported that they found no poison in these organs. The report of Prof. Wood was not absolutely conclusive, for he says: "I have been unable to obtain any positive proof of the presence of any of these poisons (prussic acid, cyanid of potash, chloral hydrate, morphin, and any other narcotic poisons) in the above mentioned organs (liver, stomach, heart, and kidneys). I feel, however, that it is much to be regretted that the contents of the stomach were lost at the time of autopsy, since the chemist relies chiefly upon the analysis of the contents of the stomach for the detection of certain

poisons, and especially of prussic acid, cyanid of potash, and chloral hydrate. Therefore, the failure to detect certain of the above poisons in the material received by me for analysis in this case does not prove that death was not caused by one of them."

While there was no suspicion at the time of autopsy that death was caused by suicide and Medical Examiner Draper was justified in finding the report that he did, the life insurance companies became suspicious as mentioned above. In view of the reports of the three chemists, some of the companies paid their policies in full, while others effected a compromise, the latter feeling that they had a sufficiently strong case in view of Dr. Wood's report.

There is no question but that insurance companies are exposed to all kinds of frauds, leading in many cases to the perpetration of murder for the sake of collecting a small amount of insurance.

The insurance of the lives of others is considered objectionable on the ground that it tends to create an interest in the death of the person, and may lead to murder for the obtaining of the insurance money.

Where the insurance is effected on one in whom the person insuring has a direct legitimate interest it is valid, otherwise it is void. This is held by law for the purpose of preventing gambling in policies, and to guard against the risk of persons insuring and then contriving the death of the insured.

CHAPTER XXII.

MEDICAL WITNESSES. EVIDENCE. TESTIMONY

Practicing as a physician is generally sufficient to qualify a person to give evidence as a medical expert in the absence of conflicting proof. Physicians are presumed to be competent to testify concerning all matters pertaining to their profession. It is not necessary that a physician or medical witness should be a specialist to render his testimony admissible as that of an expert. And a person having the required qualifications is not debarred from giving an opinion by the fact that he is not a practitioner, whether or not licensed, in the absence of a statutory prohibition, and his reputation has nothing to do with his competency. The question whether a physician is competent to testify as an expert is one for the decision of the court. A medical opinion may be based upon a medical examination, and the physician may testify to the condition of the patient at the time when he made the examination although it may have occurred a long time previously. Further, the opinion may be competent though it is based in part upon the statements of the patient, although it may not be based wholly on the patient's statements made privately to the witness. A physician may testify as to what results will follow with reasonable certainty from conditions observed by him, and such testimony is competent, although the uncertainty of a medical opinion is founded upon present conditions.

Unless the opinions of physicians can be regarded as involving some matter of medical science or technical skill, they are not admissible as expert evidence, and such an opinion upon a question which can be answered by the jury without the aid of professional skill and experience is not expert. The distinction between what is a matter of science and one of common experience upon which the witness may testify is one for the court.

The nature and extent of injuries and the present condition of a person ill or injured are properly within the province of medical skill and science, and are proper questions for an expert opinion. And a physician may give his opinion based on such conditions, and the nature of the injuries in the question, as to the cause from which they arose, and

as to whether they were produced by violence or disease, and as to whether such a condition could have existed if described circumstances had taken place. Such opinions may be founded on personal experience and observation, or they may be founded upon a statement of the nature of the injury and subsequent symptoms and present physical condition as testified to by others, or upon a hypothetical question stating the facts of the case upon which an opinion is desired.

A medical witness may give his opinion as to the cause of death when such cause is doubtful, and there was no witness to the occurrence. He may also give an opinion as to which cause produced death where death may have resulted from several causes; he may also give an opinion as to how the injuries were inflicted; whether they were inflicted before or after death; or whether they could have been inflicted in a given way.

Opinions of physicians are competent as to the location, character, and probably consequence of wounds as prosecution for homicide or assault with intent to kill. The opinion of a surgeon is competent as to whether or not a wound is a fatal one; also as to the nature of the instrument with which a given wound was produced, and further, as to whether or not the wound was inflicted before death.

Where it is attempted to distinguish between human blood and that of some animal, the question is one of science requiring the application of great skill and knowledge, and the testimony must be that of an expert.

In cases of poisoning, the chemical analysis of the organ conducted by chemists whose conclusions are based upon experience as well as upon study is of more weight than those of physicians who are not professional chemists and have had no experience in this line, although the testimony of such physicians is not incompetent. The chemist may testify as to the action of poisons upon the human system, though he may not be a physician.

The weight of expert evidence is a question for the jury, and its value must be made to depend upon the actual facts of the particular case.

A witness is not allowed to read from his own works to support his testimony nor can a witness quote statements made in medical books. Although medical books are not considered admissible as evidence, medical experts may give opinions which are competent though they are found in such books in part. Questions may be framed from standard medical books, to be asked of medical experts as to their opinions, but the opinion given by an expert under such circumstances must be his own independent of that expressed in the book.

In many of the States the disclosure by physicians of confidential

information acquired from their patients is prohibited by the statutes; but this is not uniform, and each case must be decided upon the statutes governing that particular State.

For further and more detailed information as to the provisions of law affecting physicians in various ways the reader is referred to the very excellent compilation as given in Wharton and Stillé's "Medical Jurisprudence," 1905 Edition, Vol. 3, to which the author mainly owes most of the above abstractions.

Medical Witnesses.—When a medical man has obeyed a subpœna, he is required to attend court and to state the opinion which he has formed from the medical facts of the case as well as the grounds for these opinions. Some medico-legal writers have attempted to lay down rules respecting the manner in which a medical witness should give his evidence, but they are of little value at the best, as so much depends on the personality of the individual. The medical witness should be well prepared in all parts of the subject on which he is to give evidence. He should act as an educated gentleman and his demeanor should be suited to the occasion on which he appears. He should never lose his temper nor should he be ruffled at all if his professional qualifications or experiences or the grounds for his opinions are very closely investigated. Above all, he should appear to tell the truth. He should not engage in a personal argument with the counsel, for such encounters invariably tend to the witness's detriment.

In England, the medical witness has no privilege of refusing to answer certain questions as to facts that may have come to his knowledge through confidential communication with his patients; but in the United States there is a wide divergence from this view. The statutes of the State of New York, for example, say: "No person duly authorized to practice physic or surgery shall be allowed to disclose any information which he may have acquired in attending any patient in a professional character, and which information was necessary to enable him to prescribe for such patient as a physician or to do an act for him as a surgeon." Further, "A person duly authorized to practice physic or surgery shall not be allowed to disclose any information which he acquired in attending a patient in a professional character, and which was necessary to enable him to act in that capacity."

Many of the States have adopted substantially the same provisions, namely, Arizona, Arkansas, California, Idaho, Indiana, Iowa, Kansas, Missouri, Montana, Nevada, New York, Oregon, Utah, Washington, Wisconsin, and Wyoming.

To the physician in America, at least, it must seem a monstrous thing to be required to disclose secrets affecting the honor of families, and the statutes of some States have taken cognizance of this on the ground that

public policy and the best interests of society are thereby promoted and subserved.

Taylor lays down the rule admirably, as follows: "The safer rule for physicians is never under any circumstances to reveal the confidence of his patient, and to preserve inviolate every secret obtained in the course of his professional practice. Let that be his standard and motto, and let the consequences take care of themselves. The courts will honor, rather than punish, the physician who holds his patients' secrets higher than personal considerations; and the physician who, under any pretence or excuse, violates his obligation in this regard, will suffer, as he would justly deserve, the censure of all honorable minds, and be properly in heavy damages in case the question came before a court or jury."

The witness is questioned as to his knowledge of facts in the case. These questions cannot be leading questions; that is, questions that suggest their own answers. Occasionally leading questions may be employed by the attorney where the witness is "hostile". When this first direct examination is concluded, the witness is then subjected to cross-examination by counsel of the opposite side. Here, leading questions are not only allowable, but are the usual procedure. If the physician shows himself a partisan in the case he is apt to be severely dealt with. It is here that the witness is closely questioned as to his qualifications or time during which he has been practicing medicine, the accuracy of his judgment, his professional knowledge, and his special experience in reference to the matter at issue. The witness should be perfectly frank in his answers to all of these questions. If he attempts to evade, the chances are decidedly against him and he may be brought up with a round turn to his discomfort. Of course, the less important the witness is the less he is, as a rule, cross-examined, but when expert witnesses are called in criminal cases they must expect to stand cross-examination, its severity depending upon the skill of the opposing counsel.

After this cross-examination, further examination by the counsel who conducted the first examination follows. This is generally to clear up or explain portions of the direct examination that may have been obscured by the cross-examination. This may be followed by further cross-examination, especially if new points have been brought out. In his examination the medical witness should remember that his testimony as to facts must not be influenced by their probable influence upon the case in trial. So far as he testifies to opinions, they should be carefully formed and then honestly adhered to. Occasionally a medical witness is questioned from books by medical authorities, and the witness is asked whether he agrees with the views of the author or not, and his reasons therefor. The witness in such cases should be on his guard

that the quotation is fairly made and is properly taken with the rest of the context. In fact, it is better to ask to see the quotation in question in order that he may be sure that the passage is correctly quoted. There is a tendency, however, in the courts to bar the use of books as evidence as they tend to confuse and mislead jurors.

Generally witnesses are allowed to appear in court to hear the testimony of other witnesses. This is almost essential to the proper presentation of the medical witness's testimony. For medical witnesses, unless they are fully acquainted with the facts, can give no opinion, and they can best become acquainted with the facts by being allowed to be present to hear the evidence in court.

The medical witness should, so far as possible, give direct answers to the questions asked. Most of them will admit of a simple "yes" or "no". If the question is so formed that the witness feels that a simple reply may mislead the court he can appeal to the judge to allow him (the witness) to qualify it or add to it in any matter within his own knowledge. Unless the witness is careful, he may find that his replies may be worked into such a shape as to represent the opposite to what he intended. Many lawyers comprise two or three questions into one, or ask a series of questions which may be answered by opposite terms, only one of which may fix the witness' attention, and to which he intends his answer to apply, and he may find later, to his discomfort, that he has been put in a wrong light. Under such circumstances, he should ask that the questions be put separately in order that he may give separate replies. Never should a witness attempt to argue with the counsel. The witness' replies should be concise and distinct, and should not be verbose except where explanation is necessary. He should answer the question that is asked, not the one he thinks ought to be asked. Voluble and profuse explanations of answers often open up avenues for cross-examination, which are to be avoided in the interest of the witness. If in the direct or cross-examination all evidence that such a witness may know in the case has not been brought out, the witness may volunteer to state such facts, and on application to the judge he will be allowed to do so in spite of the attempts of counsel to keep them out. The answers to the questions should be as concise as possible. They should not be ambiguous or evasive. If ambiguous then the witness is asked for an explanation.

Opinion evidence should always be accompanied by reasons. If the witness is doubtful as to the matter at issue let him say so, rather than have the fact brought out piecemeal by questions. Replies should be made in as simple language as possible, free from technicalities.

A physician is apt unconsciously to speak in medical terms, but he must remember that the jury are ordinary men unused to such phrases.

He should be careful to always speak in common language which is easily understood by those whom he is addressing—that is, the judge, the counsel, and the jury. He should be careful to describe exactly the condition and not exaggerate nor, on the other hand, underestimate the severity of an injury about which he is testifying.

Where a medical witness gives opinion evidence, he should be careful that this opinions are based on HIS OWN particular knowledge. His opinions must not be based on the statements of others nor on mere hearsay. He should confine his opinion to his own special knowledge and not attempt to go outside of it unless he is also an expert in other matters. That is, he should not attempt to be a detective unless he is an expert in that profession as well as in medicine. He should confine his opinions strictly to those subjects upon which he can give competent testimony.

The fees of witnesses are regulated by the statutes of each State, and they vary so that it is impossible to give a detailed statement of them here.

Expert Evidence.—A very admirable summary of the law relating to experts and expert evidence is given in Taylor's "Medical Jurisprudence," by Mr. Clark Bell, from which the following is abstracted:

EXPERTS.—*Definition.*—An expert is one who has made the subject upon which he gives his opinion a matter of particular study, practice, or observation, and he must have a particular and special knowledge upon the subject concerning which he testifies.

EXPERT EVIDENCE.—*Definition.*—Expert evidence is that testimony given by an expert and specially skilled in the subject to which it relates or is applicable concerning information beyond the range of ordinary observation.

TESTIMONY.—The general rule of law is that witnesses must testify to facts, and not to opinions. Witnesses must state only facts, and must not draw conclusions or inferences from facts. To do so is held to usurp the province of the court or jury, and is illegal.

EXCEPTIONS.—The above are the general rules of law, but there are exceptions where the opinions of skilled experts may be taken:

(1) Where it is impossible to make the court or jury understand the matter in controversy, inferences or conclusions may be drawn.

(2) The court or jury may be informed as to physical laws or phenomena.

(3) The results of voluminous facts may be collated by a competent physician who has been shown to be competent to make the deduction.

OPINION EVIDENCE.—Opinion evidence is the conclusions or opinions of witnesses concerning propositions based upon ascertained or supposed facts by one who has had superior opportunities and greater

knowledge than the ordinary person or witness, to judge of the subject-matter of inquiry, and who, by reason of this special knowledge of and experience with the subject, is believed to be capable of arriving at a better or more reliable conclusion and judgment from facts within his knowledge concerning the question involved in the inquiry or controversy. A witness who is not an expert, but who personally knows facts may give an opinion on a matter regarding skill, after having stated the facts upon which he based his opinion. He may also give an opinion as to matters with which he is specially acquainted, or of which he has personal or particular knowledge, but which cannot be exactly or specifically described to the court or jury.

An expert physician may testify concerning the health of a certain person whom he knows personally or has treated, and so may any witness not an expert, but only as to facts within his knowledge and observation regarding the physicial condition of another, or whether he was or had been apparently in good health. A physician or surgeon, when proved to be competent, may give his opinion as to probable effects of wounds or injuries and as to whether the wounds or injuries would produce death.

A nonexpert cannot testify as to the effects of wounds or injuries.

A physician shown to be competent may testify and give opinions:

(1) As to the cause of death of a person.

(2) In malpractice cases, as to whether the treatment complained of was proper.

(3) In cases of rape, after an inspection and examination of the parts as to health, physical condition; and from the condition, whether there had been an actual penetration; the capacity of the defendant to resist; and the effect the crime would produce upon the sexual organs.

(4) As to whether an abortion had been performed or attempted.

(5) As to the nature of the disease with which a person is or has been afflicted; its continuance; its severity and probable duration; the probability of its recurrence; its effects upon the general health; its cause; the remedy; its characteristics; whether hereditary, and as to the probable state of health of the person.

Experts in the use of the microscope or familiar with scientific chemical tests may give opinions as to whether blood is human or that of animals, birds, or amphibia. The certainty with which expert evidence upon blood-stains can be given varies according to many experts upon this subject, some maintaining that an opinion that the blood is human blood is warrantable, while others claim that it cannot be differentiated with certainty from the blood of many of the domestic animals whose blood-corpuscles are of a closely related size.

An expert shown to be competent may give an opinion as to the

presence of poison in the body. Such a witness need not be a physician if he qualifies as a chemist or toxicologist. A physician, if shown to be competent, may testify as to the symptoms of any particular disease or as to whether death may have resulted from the effects of any poison. A chemist may give his opinion concerning scientific facts or knowledge, which his superior and scientific training may enable him to understand and explain and which are ordinarily beyond the reach of persons not skilled in chemistry.

The opinions of expert alienists or medical men who are shown to be competent from knowledge, study, or experience in such cases, are admissible as to the sanity or insanity of a person at a given time; and this evidence can be based upon their personal knowledge or information, or in answer to hypothetical questions based upon the testimony disclosed. Nonprofessional witnesses who are not experts, who have known and been familiar with the person whose mental condition is in question, may state facts within their personal knowledge and then give their opinions as to the sanity or insanity of a person. The subscribing witnesses to a will, whether they are experts or not, may give their opinions as to the sanity or insanity of the testator at the time he signed the will.

It has been held that a Roman Catholic priest, who is required by his priestly office to pass upon the sanity or mental state of those who receive the sacraments at his hands, is a qualified expert, and as such may answer a hypothetical question as to the sanity or insanity of an individual.

The family physician is assumed to have superior knowledge and means of information more than ordinary persons, and is competent to give an opinion as an expert.

The court in Connecticut Mutual Life Insurance Company *versus* Lathrop, 111, U. S., 612, states the law and the reasons of its general adoption:

"Whether an individual is sane or not is not always best solved by abstruse metaphysical speculations expressed in the technical language of medical science. The common sense, and we may add, the natural instincts, of mankind reject the supposition that only experts can approximate certainty upon such a subject."

"The truth is, that the statement of a non-professional witness as to the sanity or insanity, at a particular time of an individual whose appearance, manner, habits and conduct come under his personal observation is not the expression of a mere opinion. In form it is opinion, because it expresses an inference or conclusion based upon observation of the appearance, manner and motions of another person, of which a correct idea cannot be well communicated in words to others, without

embodying more or less the impressions and judgment of the witness. But in a substantial sense, and for every purpose essential to a safe conclusion, the mental condition of an individual as sane or insane is a *fact.* Not, indeed, a fact established by direct and positive proof, because in most, if not all cases it is impossible to determine with absolute certainty the precise mental condition of another. Yet, being founded on actual observation and being consistent with common experience and the ordinary manifestations of the condition of the mind, it is knowledge so far as the human intellect can acquire knowledge upon such subjects."

Opinions may be given by persons skilled therein concerning the running and management of railway trains and in railway management. Artisans, mechanics, and other persons skilled in any pursuit or calling may be examined in matters relative to his trade, concerning which he is shown to have peculiar and special knowledge.

Opinion evidence is not received if the facts can be otherwise ascertained and made intelligible to the jury, or if the question is one that men in general can understand and comprehend. *The competency of an expert is a question for the court, and it must be clearly shown before his testimony can be received as that of an expert.*

Counsel is entitled to put the case hypothetically, as he claims it to have been proved, and take the opinion of the witness thereon, it being for the jury to decide whether the question as put covers the case as proved. Juries are not bound by the opinion of an expert, and it is for them to decide what weight, if any, such evidence should be given. The court in these cases has no power over the jury.

An expert witness cannot be compelled to give his expert opinion unless he is compensated therefor. He is not liable for contempt in refusing to appear unless he is compensated, although he may be compelled to appear and testify to facts within his knowledge, the same as any other witness, his compensation in the latter case being the usual statutory fee.

It should not be forgotten that it is not the province of an expert witness to decide a case. Unfortunately, he may consider himself in such a position. His testimony is as to facts and to opinions, but in so far as they have a bearing on the case he should have nothing to do with them. His opinion, therefore, is not a dogmatic statement of fact, but merely his belief.

The criticism that is occasionally made of expert testimony that it is uncertain and contradictory and that experts can be found who will testify on both sides of the case, finds its analogy to a certain extent at least in practitioners of the law. Otherwise there would be no necessity for the higher courts if the lower ones were always free from error and

infallible. An expert should never forget that he is better qualified to testify and that he has a greater knowledge of the subject than the lawyers who cross-examine him. The expert should answer the questions according to his own knowledge and opinion and not be led by the lawyer into a pitfall.

CHAPTER XXIII.

SOME LEGAL POINTS AFFECTING PHYSICIANS

No adult person of sound mind is responsible to another for his or her health and cannot be held liable in any way for refusing to call in a physician. This, however, does not apply to minors. The common law requires that parents or guardians should care for those under their charge in sickness and in health, and they should do whatever may be necessary for their preservation, including the furnishing of medical attendance if necessary. Refusal or neglect on the part of the parent or guardian resulting in the death of the child or minor who is under such care renders parent or guardian criminally responsible by the common law. The opinions of parents or guardians, so far as they relate to special schools of medicine or to prejudices or superstitious ideas, are no excuse for disobeying the provisions of the common law. But a parent or guardian is not held criminally liable for the death of a child or minor upon mere hearsay of witnesses that the life might have been prolonged if medical attendance had been secured. It is necessary to show that the neglect of the parent or guardian actually shortened the child's life. It is not sufficient to show that the parent only neglected to use the ordinary means of saving the child's life.

A person who has suffered a personal injury by another may recover therefor, even though the injured person treats himself instead of calling a physician, where it is shown that the injured party pursued the same course of treatment that ordinarily would have been adopted by a physician.

Services rendered by a physician to a patient are in the nature of a contract, and the principles of the common law apply to the services of a physician as well as to the services of others. The contract may be formal or it may be implied. Where services are rendered by a physician and accepted by the patient, there is an implied contract to pay for them. Services rendered on Sunday are on the same footing as those rendered on weekdays, and the contract is binding, as such services are excepted in the statutes prohibiting labor on the Sabbath. Where a patient pays a physician to cure him of a disease and where a condition in the contract prescribes further treatment in the case of a non-cure, the

physician may retain the sum paid him where the patient neglected or refused further treatment.

A physician is not compelled to treat a case against his own inclination. He may elect whether he will treat it or not. If he decides to treat the patient the contract continues as long as the services last, unless the physician is expressly discharged by the patient or until the physician gives notice and opportunity for the patient to secure other medical attendance. It is for the physician to determine how often he should visit the patient; and where the patient accepts such attendance without objection or modification, the physician can collect on the ground that such services were necessary. But a physician and his employer may make such a contract as they think necessary, and the attendance may be limited.

Where there is no special contract between the physician and his employer, the physician may collect although a cure was not effected. The physician does not insure the success of his treatment unless expressly stipulated in the contract. But a physician may contract to effect a cure, in which case he can only collect for services rendered upon showing the fulfillment of the terms of the contract.

Where a third party contracts with a physician for medical services for another, it is usually held that the third party is not the agent of the patient and that he is under no legal obligation to pay for such services, except, of course, where there was legal obligation on his part to pay.

A husband is held liable for the services rendered his wife, though he may be considered a third party, and when the husband is absent the wife may employ a physician to be paid for by the husband. Where a husband places his wife in the care of a physician for treatment, the physician may proceed without further notice to the husband in adopting such course as in his (the physician's) judgment will be most effective toward her recovery. The wife may by express agreement pay for her own care, but even though she summons the physician she is not to be held responsible in the absence of express contract. A wife, however, cannot be held liable for medical attendance upon her husband unless distinct proof can be shown that she made the contract.

The father is liable for attendance upon his minor child, but not upon a child who has reached his maturity although living under the same roof or sick at the father's house. The general rule is, that where a physician is requested by a party to render services to any member of his family the physician should look to him for compensation in the absence of notice that some one else is to be held responsible, and under this rule a child may be held responsible for medical services rendered an aged

parent whom he has received into his family, although he is not compelled to receive such parent into his family.

An ordinary employer is under no legal obligation, as a rule, to furnish medical attendance to his employees unless there is a special agreement therefor; but an employer is liable for medical attendance which he procures for his employee for which he agrees to pay.

A physician called in consultation by another physician may recover where the party, employing the regular physician, received such services without objection, and recovery is not prevented, by an agreement between the regular physician and the patient, to the second physician that the regular physician should pay the consulting one.

A physician attending a patient is expected to possess and to bestow upon the patient such reasonable and ordinary skill as a physician practicing in similar localities in the same general line of practice ordinarily exercises in such cases. He is bound at all times to use his best judgment and in cases of doubt to use the best course of treatment, and he is also to employ remedies and appliances such as discovery and experience have found to be the most approved and beneficial to secure recovery in the individual case.

One who practices as a specialist must exhibit that degree of skill and knowledge which is commonly practiced by a physician engaged in that specialty, but he is not required to use the highest possible degree of skill. That degree of efficiency and skill that is ordinarily exercised in the treatment of patients is all that he can be required to use. The ordinary care, diligence, and skill relates to professional duties only, and does not include nursing. He is not compelled to nurse his patients, though he may be required to inform others how it should be done. Where a particular disease allows of only one sort of treatment, any departure may be regarded as a result of want of skill or experience or attention. And failure to exercise ordinary skill, although the physician may be possessed of such, constitutes negligence. A physician is not allowed to experiment with patients to their injury.

Ordinary skill is to be judged by the school of practice to which the physician belongs, and a physician of a particular school must come up to its average standard. The ordinary care and skill of the physician may vary according to the locality and possibilities for observation and practice. A physician practicing in a small village is not expected to possess that high degree of skill possessed by physicians practicing in large cities, although the latter in turn are expected to use the ordinary skill of the physicians in their own locality.

A physician treating a patient gratuitously is required to give the same degree of care and skill as when the physician receives compensation. If a physician in his first attendance on a case feels incompetent,

he may recommend the employment of another physician; but if he feels himself competent and undertakes the case, he must use his best judgment as to whether he will consult some other physician.

While in England formerly, under the common law, physicians could not sue to recover fees for services, since the passage of the medical act they are entitled to recover. And this has always been the rule in the United States, that the law implies a promise to pay a reasonable compensation for services and that action to recover may be maintained. A physician is entitled to such compensation when there is no previous agreement, as is the custom for such services in the community where he practices. Often this is a case for the jury to determine the various factors that enter into consideration and to draw its own conclusion as to the amount. The rule that the patient's financial condition must be taken into consideration has been held in some cases and thrown out in others. It is assumed that the professional visits are necessary and are properly made where no objection is raised on the part of the patient and the patient is liable to the physician therefor. In many States statutes provide that unlicensed physicians cannot collect for services rendered, and even the absence of express prohibition against practicing for compensation where the statute requires every person desiring to practice medicine to possess certain qualifications as a prerequisite, when one fails to comply cannot recover for professional services, whether the contract is implied or expressed. And where a registration of a license or diploma is required by statute, making it a penal offence to practice without such recording or registration, no action can be maintained for medical services. But where there is no legal penalty for a practitioner failing to make such record, the physician may recover for services. Sickness on the part of the physician at the time of the meeting of an issuing license board is not an excuse for failure to obtain such license to practice and does not enable the physician to maintain an action for services rendered without such license.

Generally the services of the physician attending the last illness of a patient are considered a preferred claim by statute over ordinary demands upon the estate of the deceased.

PART II.

TOXICOLOGY

CHAPTER I.

TOXICOLOGY

The science of toxicology is that which treats of poisons, their origin, properties, action on the system, the treatment of their effects and their detection by chemical, physiological, or other means. By the term "poison" we ordinarily understand a substance having an inherent deleterious action which makes it, when taken into the system, capable of destroying life. In common language, poisons are understood to be those substances which may produce a fatal result when taken in small doses, such as strychnin, hydrocyanic acid, etc. On the other hand, from a broader point of view, substances which destroy life from their mechanical action may be considered poisons. "Whosoever administers to another, for the purpose of injuring his health, poison or other substance which is capable of injuring his health, shall be punished, etc."

"Whosoever shall administer, or cause to be administered to, or to be taken by any person, any poison or other destructive thing, with intent to commit murder, shall be guilty of felony."

The French law inderdicts the willful administration of any substances "which, without being of a nature to produce death, are injurious to health." Another definition adopted by recent authors divides poisonous substances into two classes, namely, poisons and corrosives: the former, a substance "which being in solution in, or acting upon the blood, may cause death or serious bodily harm; the latter, a substance capable of causing death or injury by its chemical action upon a tissue with which it comes in contact." Another authority who takes a different view of the subject says: "The law does not regard the manner in which the substance acts. If it is capable of destroying life or injuring health is of little consequence, so far as the responsibility of the person is concerned, whether its action is of a mechanical or a chemical nature, and whether it operates fatally or not." The same author lays stress upon the words "poison or other destructive or noxious things, so as to endanger the life of such person, or so as thereby to inflict upon such person any grievous bodily harm". Attention is called to the ruling of the judge who supported the contention of the defense, "that there must be

a distinction between a thing only noxious when given in excess, and a thing which is a recognized poison, and is known to be a thing noxious and pernicious in its effects; that unless a thing was noxious in the quantity administered it cannot be said that there has been a noxious thing administered."

If the definition of a poison is dependent upon the amount administered, the number of poisonous substances must be modified by the dose of a substance which makes such a substance act as a poison. To show how difficult this would be, we may mention a few well-known substances, not ordinarily considered poisons, which might endanger life if taken in large quantities: common table salt, and even water, when forced into the stomach in large quantities. So that it becomes a question for a medical expert who is well trained in toxicology to pass an opinion upon the quantity of a substance supposed to have been ingested, whether such body was injurious to health, and in what way it might have caused death. As a rule, after the ingestion of poisonous substances, the person is more or less affected, even when not fatally; but a person may become accustomed to large amounts with impunity, which, if taken by one not so used to their effect, would be followed by a fatal result. For example, arsenic eaters and opium fiends may take amounts of these substances far in excess of those necessary to produce death in one not accustomed to their use. On the other hand, a so-called idiosyncrasy may produce a fatal result when only a medicinal dose has been administered. So that from this it is seen how difficult it is to give an exact definition of the word "poison." The expert should be able to explain the manner in which a substance in any given case usually destroys life, and the amount necessary for this purpose.

Many substances not heretofore classed as poisons have produced symptoms which could surely be called poisonous, and the results of exact chemical investigation have proved that these substances are of the nature of a poison. Substances which may be mentioned are those which are present in food, both animal and vegetable, as the result of fermentation; others known as toxins may produce gastric and intestinal irritation, even causing severe enteritis, and by further process these substances may be absorbed into the blood and cause symptoms of intoxication. Ptomains and toxins, as they are called, are difficultly distinguishable from the vegetable alkaloids and properly belong in a discussion of the general term toxicology.

Disease or disturbed bodily functions sometimes render the system tolerant of substances which would be poisonous if administered in the same quantity to a healthy person. In alcoholism, for example, the blood and tissues are so loaded with alcohol as to interfere with the absorption of certain poisonous agents, so that chloral hydrate, digitalis,

and opium may be given in larger and more frequent doses in delirium tremens than is safe to a normal person. Occasionally, fatal accidents have occurred from the repetition of large doses to intoxicated patients after they have eliminated the alcohol and recovered from its effects. On the other hand, certain diseases render the system more susceptible to the action of poisons. This is seen in the administration of small doses of mercury to those affected with some renal disturbance, whereby salivation is easily produced, also in those who are fit subjects for apoplexy, in the administration of narcotics. So that the effect of a poison is largely dependent upon the state of the system, and this fact must be borne in mind when forming an opinion in any given case.

The evidence in cases of poisoning is derived from several facts, for example, the symptoms, postmortem appearances, the chemical analysis and, occasionally, experiments on animals. These may be called the clinical, anatomical, chemical, and physiological signs. In addition to these we have the so-called moral evidence which may be apparent to others besides physicians who are immediately connected with the case. Everything, no matter of how little importance it may seem, that occurred during the patient's life, should be observed and accurately noted in order to establish the fact of poisoning absolutely. Especially the physician attending the patient should take charge of and carefully guard everything that may be of any possible evidence, such as vomitus, urine, feces, medicines, powders, or any article of food or drink taken previously. The vomitus and urine are of particular importance when collected during the patient's life, and these should be examined. The statistics of poisoning that have been recorded show that the amount of poison varies greatly according to circumstances, especially as to the ease with which a particular poison can be purchased and the popular knowledge concerning the poisonous action of a substance commonly used in the arts and manufactures.

Statistics.—The following statistics taken from a recent talk on this subject by Mr. Blyth show the number of cases of people who have died from poisoning in England and Wales.

TABLE A.

DEATHS FROM POISONS IN ENGLAND AND WALES DURING THE TEN YEARS 1883–1892.

	Accident or negligence		Suicide		Murder		Total	
METALS:	M.	F.	M.	F.	M.	F.	M.	F.
Arsenic	37	14	37	20	1	1	75	35
Antimony	3	...	1	2	...	...	4	2
Copper	4	1	2	1	...	...	6	2
Lead	831	209	1	2	...	...	832	211
Silver nitrate	1	...	...	...	...	...	1	...
Zinc chlorid (or sulphate)	7	...	4	...	...	...	11	...
Mercury	22	11	16	8	2	1	40	20
Chromic acid	1	...	...	...	...	...	1	...
Iron perchlorid	...	...	...	1	...	...	...	1
ALKALINE EARTHS:								
Lime	2	...	...	1	...	...	2	1
Barium chlorid	1	...	..	...	...	...	1	...
THE ALKALIES AND THEIR SALTS:								
Ammonia	39	25	18	16	...	...	57	41
Caustic soda	3	4	...	1	...	...	3	5
Caustic potash	8	10	1	...	...	...	9	10
Potassic chlorate	1	...	...	...	...	...	1	...
Potassic bichromate	2	2	7	3	...	...	9	5
Potassic bromid	1	...	...	..	...	...	1	...
Potassic binoxalate (sorrel)	1	3	1	4	...	...	2	7
ACIDS:								
Sulphuric acid	30	9	29	24	1	...	60	33
Nitric acid	18	7	18	9	...	...	36	16
Hydrochloric acid	48	18	83	55	...	...	131	73
Oxalic acid	17	6	114	86	...	...	131	92
Tartaric acid	...	1	...	...	...	...	...	1
Acetic acid	4	3	...	2	...	...	4	5
Carbolic acid	169	101	219	271	..	1	388	373
Hydrofluoric acid	...	...	...	1	...	...	...	1.
Phosphorus (including lucifer matches)	24	47	28	56	...	...	52	103
Iodin	6	7	1	1	...	...	7	8
VOLATILE LIQUIDS:								
Paraffin (petroleum)	9	2	1	...	...	...	10	2
Benzolin	3	2	...	1	...	...	3	3
Naphtha	1	...	...	...	...	...	1	...
Carbon bisulphid	...	...	1	...	...	...	1	...
Turpentine	5	1	...	3	...	...	5	4
Methylated spirits	...	2	1	2	...	...	1	4
Alcohol	81	24	1	2	...	...	82	26
Chloroform	57	41	9	5	1	...	67	46
Ether	5	2	. .	...	...	...	5	2
Spiritus etheris nitrosi	1	...	...	...	...	...	1	...
Anesthetic (kind not stated)	4	3	...	...	...	...	4	3
Oil of juniper	1	...	...	...	...	...	1	...

TABLE A.—*Continued.*

DEATHS FROM POISONS IN ENGLAND AND WALES DURING THE TEN YEARS 1883–1892.

	Accident or negligence		Suicide		Murder		Total	
OPIATES AND NARCOTICS:	M.	F.	M.	F.	M.	F.	M.	F.
Opium, laudanum, morphia	503	373	330	167	4	2	837	542
Soothing syrup, paregoric	18	22	2	3	...	...	20	25
Chlorodyne	56	30	8	8	...	...	64	38
Chloral	89	22	14	1	1	...	104	23
CYANIDS:								
Prussic acid and oil of almonds	17	11	203	19	2	8	222	38
Potassium cyanid	19	21	100	22	3	1	122	44
ALKALOIDS:								
Strychnin and nux vomica	22	21	65	85	4	4	91	110
Vermin killer	2	6	49	69	1	...	52	75
Atropin	2	...	1	...	...	...	3	...
Belladonna	36	20	11	9	...	...	47	29
Aconite	19	21	9	10	...	...	28	31
Ipecacuanha	1	1	...	...	...	...	1	1
Cocain	3	...	...	...	...	...	3	...
MISCELLANEOUS:								
Antipyrin	1	...	...	...	...	...	1	...
Cantharides	1	...	...	1	...	...	1	1
Camphorated oil	1	...	...	...	...	...	1	...
Croton-oil	1	...	...	...	...	...	1	...
Cayenne pepper	1	...	...	...	...	...	1	...
Syrup of rhubarb	1	...	...	...	...	...	1	...
Colchicum	2	...	...	...	...	...	2	...
Hemlock	3	1	...	...	...	...	3	1
Water hemlock	5	6	...	...	...	...	5	6
Colocynth	...	2	...	...	...	...	...	2
Castor oil seeds	1	1	...	...	...	...	1	1
Laburnum seeds	2	1	...	...	...	...	2	1
Thorn apple	1	...	...	...	...	...	1	...
Yew leaves or berries	3	2	...	...	...	...	3	2
Crowfoot	...	1	...	...	...	...	...	1
Whin flower	1	...	...	...	...	...	1	...
Pennyroyal	...	1	...	...	...	...	...	1
Meadow crowfoot	...	1	...	...	...	...	...	1
Arum seeds	...	1	...	...	...	...	...	1
Bitter aloes	...	1	...	1	...	...	...	2
Cocculus indicus	...	...	1	...	...	...	1	...
Horsechestnut	...	1	...	...	...	...	...	1
Creasote	1	...	...	...	...	...	1	...
Spirits of tar (oil of tar)	2	1	...	...	...	...	2	1
Nitroglycerin	1	...	...	...	...	...	1	...
Camphor	...	1	...	...	...	...	...	1
Tobacco	4	...	1	...	...	...	5	...
Lobelia	1	...	...	...	...	...	1	...
Fungi	13	10	...	...	...	...	13	10
Poisonous weeds	2	...	...	...	...	...	2	...
Hellebores	...	...	1	1	...	...	1	1
Kind not stated	216	158	256	167	3	1	475	326
TOTAL	2498	1292	1644	1140	23	19	4165	2551

The following table made from the reports of the Medical Examiners of Massachusetts to the Secretary of State is taken from Wharton and Stillé's "Medical Jurisprudence."

TABLE B, EXHIBITING CASES OF DEATH FROM POISONS, COMPILED FROM ORIGINAL RETURNS FROM MASSACHUSETTS MEDICAL EXAMINERS TO THE SECRETARY OF STATE, 1877–1902, INCLUSIVE.

(1) *Noncriminal (Accident or Negligence).*

	'77	'78	'79	'80	'81	'82	'83	'84	'85	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	Total
Arsenic compounds	...	1	...	2	...	...	1	...	2	2	...	...	2	...	...	4	...	...	2	4	2	1	...	4	...	2	29
Opium preparations	...	...	3	1	4	...	5	1	3	...	...	4	2	1	1	3	2	7	6	6	2	3	7	...	5	8	74
Strychnin	...	...	...	...	...	1	...	...	...	...	...	1	1	1	...	...	...	...	2	2	1	2	1	2	3	2	19
Chloral hydrate	...	...	1	...	3	3	1	1	...	...	...	...	...	...	...	...	...	...	1	2	1	1	...	...	...	...	14
Mercury bichlorid	...	...	...	...	...	...	...	...	1	1	...	1	...	...	...	...	...	...	2	...	...	1	1	...	3	...	10
Phosphorus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	2	...	1	...	...	1	...	6
Carbolic acid	...	...	...	...	1	...	1	2	1	...	...	...	1	1	...	...	1	3	2	...	1	2	3	...	...	2	21
Prussic acid, etc	...	...	...	...	...	...	...	...	1	...	...	1	...	...	...	...	3	...	...	...	...	...	...	...	...	...	5
Muriatic acid	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1
Methyl alcohol	...	...	...	...	1	1	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	6	...	10
Chloroform	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	3	1	...	...	...	...	...	...	...	6
Aconite	...	...	...	...	...	1	...	1	...	1	1	1	...	...	...	...	...	...	...	...	...	1	...	...	...	...	6
Oxalic acid	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	3
Ammonia, including washing fluid	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	2	...	1	...	...	5
Digitalis	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	3
Cedar, oil of	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1
Wintergreen, oil of	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	6	...	...	1	...	...	...	...	...	8
Tansy, oil of	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	2
Lobelia	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Canned corn	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Podophyllum	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Castanea nuts	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	1
Wild parsnip root	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	...	1	...	...	...	...	...	3
Soapine (potash)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	1
Embalming fluid	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Nitric acid	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	1	...	...	...	2
Stramonium seeds	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	1

(1) *Noncriminal (Accident or Negligence).—Continued.*

	'77	'78	'79	'80	'81	'82	'83	'84	'85	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	Total
Lead	...	...	...	...	...	...	1	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	2
Coal dust	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	1
"Acetanilid"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	1	...	...	...	2
Caustic potash	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	1
Narcotic compound	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
"Fly paper"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	2
White hellebore	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	1	2
Water hemlock (cicuta mac.)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1
Rattlesnake bite	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	...	4
TOTAL	...	1	5	3	9	6	11	8	8	8	1	8	6	5	4	7	7	23	19	18	11	16	15	9	26	17	251

(2) *Criminal (Homicide).*

	'77	'78	'79	'80	'81	'82	'83	'84	'85	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	Total
Alcohol (death twelve hours)	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Arsenic, compounds of	...	1	...	2	...	...	...	...	...	5	...	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	10
Opium preparations	...	...	...	...	...	...	...	...	...	1	2	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	4
Strychnin	...	...	...	...	...	...	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
Muriatic acid and soldering salts	...	...	...	...	...	...	...	...	...	...	1	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	3
Chloral hydrate	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Turpentine	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Tansy, oil of	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Cedar, oil of	...	1	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
Pennyroyal, oil of	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Kerosene oil (external)	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Prussic acids and cyanids	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	2
Methyl alcohol (wood)	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Not stated	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
TOTAL	...	4	...	2	...	...	2	3	1	7	4	2	2	...	3	...	2	...	...	...	...	...	...	...	...	...	32

(3) *Noncriminal (Suicide).*

	'77	'78	'79	'80	'81	'82	'83	'84	'85	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	Total
Arsenic, compounds of	2	2	6	3	2	2	3	16	13	13	33	22	26	15	17	20	20	18	16	29	22	23	16	14	13	14	380
Opium preparations	4	4	5	5	1	2	8	10	14	6	10	16	17	23	21	27	21	21	20	27	20	16	19	13	14	13	357
Strychnin	...	...	...	...	1	...	...	...	2	2	2	1	2	4	...	1	1	1	1	1	...	1	...	3	3	1	27
Zinc, salts of (soldering)	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...	1	...	...	...	...	1	2	...	2	1	1	10
Chloral hydrate	...	...	1	...	...	1	1	...	1	...	...	3	3	2	2	5	4	...	1	2	3	1	1	3	...	...	34
Chloral with hyoscyamus	...	...	...	...	...	1	1	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	4
Chloral with morphin, etc	...	...	...	...	...	...	1	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3
Creasote	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	2
Hemlock, oil of	...	...	...	...	...	...	...	...	...	...	...	1	2	...	...	...	...	...	...	...	...	...	...	...	...	...	3
Mustard, oil of	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	1
Mercury bichlorid (cor. sub'ate)	...	...	1	...	1	...	1	2	...	...	1	1	1	...	1	...	2	...	1	4	1	2	2	2	...	3	26
Pennyroyal, oil of	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	1	...	...	1	1	...	...	4
Phosphorus and matches	...	...	...	...	1	...	2	...	1	1	2	...	2	...	...	...	...	...	...	1	...	1	...	...	...	...	11
Carbolic acid	...	...	...	...	...	...	...	3	2	...	...	...	4	3	1	4	3	3	2	6	15	25	20	20	20	24	155
Cresolin	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	...	...	2
Prussic acid and cyanids	...	...	1	2	...	...	1	...	4	2	1	2	2	...	1	1	4	4	4	4	6	7	7	4	4	7	68
Muriatic acid	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	1	...	...	...	...	1	...	3
Methyl alcohol (wood)	...	...	...	...	...	...	...	...	...	...	...	...	...	1	2	...	1	1	1	...	1	2	6	8	...	4	27
Chloroform	...	...	...	...	...	...	...	...	3	...	2	...	...	2	4	1	1	...	4	2	3	1	3	5	1	1	33
Turpentine, shellac, etc	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	1	...	...	...	...	...	2
Aconite	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Oxalic acid	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Ammonia and washing fluid	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Rue	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Not stated	...	...	...	...	...	...	2	...	...	...	1	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6
TOTAL	6	7	14	11	6	6	20	32	41	26	54	49	60	50	51	62	58	48	50	78	73	81	76	77	57	69	1162

Symptoms, in General.—Occasionally persons are found dead without any knowledge as to the cause, and the only suspicion of poisoning arises from finding a bottle of medicine or powder at hand or some other circumstantial evidence of similar character. Such cases are deliberately suicidal. One case is reported as follows:[1] "A man in perfect health, on a very hot day in summer, took a private room in a hotel, and, complaining of a violent headache, sent the messenger, who answered his call, to an apothecary shop for some camphor spirits, which he poured on a handkerchief and bound on his forehead, at the same time dismissing the messenger. He was found dead several hours afterward, and his death was attributed to a congestion of the brain brought on by the heat of the weather. Suspicions of suicide being aroused later, it was found that he had poisoned himself with prussic acid and disguised its smell by the external application of camphor. No bottle or paper was found in the room or about the person to point in the slightest degree to poisoning as the cause of death, yet chemical examination of the stomach showed a large amount of prussic acid. The postmortem appearances, were, of course, those of general venous congestion, found in cases of prussic acid as well as some other forms of poisoning, especially cerebral congestion."

Generally, medical aid is obtained before the fatal result ensues, and the direct testimony of the physician in attendance can be obtained. The symptoms in such cases should be recorded in great detail, as they are of very great importance.

The first effect of a drug is its local action, and this should be looked for where a poison was administered. If a corrosive poison was taken by the mouth it would show its effect locally upon the face and lips, but if it has no local effect which is visible, that is, if it is not a corrosive or local irritant, the first symptoms are due to its absorption; but if this does not occur, of course, there are no symptoms to be noticed; for example the action of arsenic may be delayed, or even prevented by the administration of milk and the subsequent washing out of the stomach. The mucous membranes afford particularly susceptible surfaces from which poisons may be absorbed, and some of them allow the absorption of a drug very rapidly. The most rapid absorption is by the lungs, stomach, intestines, mouth, nose, eyes, tear-passages, etc. The condition of the stomach, whether full or empty, plays an important part in the absorption by this organ. Besides poisonous gases and poisons more or less volatile, the lungs may also absorb poisons in a very finely divided state of dust.

When a serous membrane is irritated or inflamed it will more rapidly

[1] Wharton and Stillé. "Medical Jurisprudence."

absorb a poison, and so a smaller quantity than is habitual may produce serious results.

Subcutaneous injection affords, as a rule, a much quicker absorption than ingestion by the mouth. Morphin is a fair example of this action, as a very much smaller dose is required to produce the full effect of the drug than can be obtained by absorption by the stomach. The normal skin has a very slight absorptive action except in cases of a few ointments where the medicament is in a very finely divided state. Mercury and arsenic can be administered in this way to a considerable extent.

Where there are no marks of personal violence on the body, and the symptoms, if any, do not explain the death as attributable to natural causes, we may say there is reason to suppose that a fatal result was brought about by some poison. In the more pronounced cases, where one apparently healthy is overtaken with serious symptoms, accompanied with pain in the stomach; or when, in the absence of vomiting and diarrhea, complete prostration, a death-like countenance and free perspiration appear, followed by death, there may be good reason to suspect poisoning, which should be investigated both by postmortem examination and, if need be, by chemical examination as well. In many of the States, especially Massachusetts, the statutes require that the medical examiner shall immediately view the body and examine the circumstances of death, which are at all suspicious. His report is then made in writing to the judge and district attorney who are charged with the inquest as to the cause of death. If, for any reason, the district attorney is dissatisfied with this report, he may order an autopsy.

Often the investigation into the cause of death is seriously interfered with by the unwillingness or ignorance of those who witnessed the symptoms, and that a very large number of poisons may cause symptoms which are very similar in themselves and also similar to those of many diseases.

The fact of previous illness or the inability of the physician to sharply differentiate between certain symptoms of disease and those caused by poisoning may put him in a very unfavorable position.

In the well-known case in Massachusetts, a patient had been sick with symptoms of pneumonia, from which she had recovered to a certain extent, and later, symptoms other than those of pneumonia, were noticed, from which the patient died. The physician signed the death certificate that in his opinion death was the result of the pneumonia. As this death was closely allied with other suspicious deaths connected with the presence of the defendant in the house in each case, an inquiry was begun by the authorities, which showed that the later symptoms were due to the administration of a poison. This emphasizes the point

that every physician when called upon to attend a patient who is suffering from symptoms which are apparently sudden, and seriously endanger life, should have in mind the possibility of the administration of poison.

The following points mentioned by Dr. Luff are well worth calling attention to here:

(1) The time at which the symptoms commenced, and the nature of the symptoms.

(2) The time at which the symptoms commenced after the last ingestion of food.

(3) The occurrence of any recent previous illness from which the patient may have suffered.

(4) If the patient has vomited, the vomit should be collected, or, if necessary, scraped up from the floor or from the dress, bedding, or carpet; if necessary, a portion of the dress, bedding, or carpet containing the vomit, should be cut out and preserved.

(5) The nature of the food recently taken by the patient should be ascertained; and if suspicion attaches to any articles of food, these should be secured by the medical man and preserved under seal.

If the death of the patient occur, in addition to attending to the points above mentioned, note should be taken of the following:

(1) The exact time at which death occurred.

(2) The position of the body with regard to surrounding objects; its attitude, and the condition of the dress.

(3) All surrounding objects should be carefully observed, and any bottles, packets, or weapons in the room should be collected and preserved.

(4) The condition of the body as to lividity or pallor should be noted, and also whether the countenance presents a distressed or calm appearance.

Further evidence may be secured by careful inspection of the dead body and of the place where it lies. Any vial, powder box, cloth, article of wearing apparel, or article of furniture which may in any way point to the presence of poison, should be carefully taken in charge by the physician. On the other hand, sudden death may be caused by certain diseases, such as aneurysm, embolism, or apoplexy, which may be wrongly attributed to poison.

The duties of the medical expert and his relation to the testimony in court are spoken of elsewhere.

Absorption of Poison.—With the exception of local lesions caused by the irritant action of certain ones, poisons, as a rule, act by absorption into the circulation of the blood. They are eliminated by the excretory organs, and the ratio of absorption to elimination influences the activity of the poison. When the absorption is greater than the elimination, then we get symptoms of the action of the drug. The elimination of a drug may be so extremely rapid that it may be difficult

to cause poisoning. This is especially true of certain animals. Horses will stand the ingestion of a large amount of hydrocyanic acid, amounts which are far larger than are necessary to kill other warm-blooded animals.

Kobert, in his recent work on practical toxicology, says of the action of poisons:

"Some of the agents, such as the salts of the heavy metals, will readily combine with the protein substance, thereby causing their destruction, viz., necrosis of the tissues involved; others, such as concentrated acids and caustic alkalies, act also as powerful irritants and cause a reactive inflammation; still others, as strychnin, morphin, curare, muscarin, cause an excitation and enfeebling of the nerves, muscles, or glands of the affected parts, without any marked apparent changes.

"The remote effect is produced by the absorption of the poison into the lymphatics and into the blood, causing general symptoms and diseases of other organs—*e.g.*, of the kidneys, following the administration of cantharidin; of the brain, after taking opium; of the intestine, after quillaic acid. Practically, the remote action is really a local one produced by the poisoned blood circulating everywhere.

"The poison, as it circulates in the blood, may be either decomposed, or it may enter into the combination with the blood constituents and thus change the composition of the blood, or it may reach the various organs in its original condition. Physiology teaches us that various endosmotic changes take place in these organs, depending upon their functions, upon the formation of their constituent elements, and upon the number and arrangement of the capillaries passing through them. The chemical constitution and physical properties of the poison will determine, to a varying degree, the rôle it plays in these changes by participating in the interaction of the vessels of the tissues. The presence of this foreign substance sooner or later disturbs, to a greater or less degree, the healthy condition and function of the organs particularly affected; and, again, this cannot take place without a reaction upon the whole body. The animal organism, however, possesses four means of rendering partly or entirely harmless poisons which have entered the system:

"(1) Rapid Elimination.—Under this head, naturally, we first mention vomiting which, fortunately, occurs so promptly following the introduction of most poisons into the stomach that it generally saves the life of a patient, or at least has already materially lessened the danger to life before the physician puts in an appearance. We should call this vomiting, which takes place before the absorption of the poison, primary vomiting, in contradistinction to a secondary emesis, which takes place following absorption, and which latter is either exclusively a sign of

disturbed cerebral activity or is caused by the excretion of the poison from the blood into the stomach. In an analogous manner we must differentiate between a primary diarrhea, which carries off the poison before absorption, and a secondary purging, which is a sign of disturbed intestinal innervation, or is caused by the excretion of the poison from the blood into the lumen of the gut. Some poisons are not removed by vomiting or purging, but appear in the urine in a remarkably short time. Thus, for example, it is impossible to produce complete curarization by the administration of moderate, though oft-repeated, doses of curare, because the excretion of the poison through the kidneys takes place as rapidly as does absorption. The liver, pancreas, gastric mucous membrane (for morphin), intestinal mucous membrane (for mercury), salivary glands, mammary glands, and lungs and other channels are effective in assisting the excretion of various substances from the blood. Not nearly enough attention was formerly given to the excretion through the glands of the mucous membrane of the stomach. Finally, elimination takes place through the structure of the skin, especially through the sweat-glands.

"(2) The organism deposits and fixes poisons, in a manner not yet sufficiently understood, in several organs, especially in the liver, which certainly must be regarded as a filter for poisons, so far, at least, as enzymes (*e.g.*, emulsin), metals(*e.g.*, iron), metalloids (*e.g.*, arsenic), and alkaloids (*e.g.*, strychnin) are concerned. It is probable that, in the case of some substances, the biliary acids play an important part in the matter. We can hardly imagine that this disposition is accomplished in any other way than in the transformation of the readily soluble poisons into saline combinations, not freely soluble (bile-acid-alkaloids) or into albumen derivatives (metalbuminates). But, since these combinations are in no case entirely soluble, the beneficial action of the liver consists only in the fact that it gives the acute poisoning a more protracted, and consequently a milder, form.

"(3) The organism renders the poisons innocuous by phagocytosis. This destructive crusade carried on in the interests of the body by phagocytes, which has not yet been sufficiently inquired into pharmacologically, is applicable for certain toxalbumins (toxopeptone, enzymes), as well as for heavy metals.

"(4) The organism transforms the poison into a comparatively harmless, though readily soluble, combination. Such a transformation may consist of neutralization, oxidation, reduction, coupling, splitting, and peculiar changing of the chemical constitution. 1. As an example of poisons rendered inert by neutralization, we must mention the acids, which are transformed, as far as possible, by the organism into the corresponding alkaline salts of less poisonous, or absolutely nonpoisonous,

properties. So far as the stomach is concerned, the organism attempts to balance any excess of alkali by the acids of the gastric juice and does the same thing in the blood by the decomposition of an immense number of blood-corpuscles, whereby glycero-phosphoric acid is formed from lecithin. Caustic lime is combined with carbamic acid and then excreted. 2. The best-known example of inertia produced by oxidation is that of phosphorus, which is transformed into phosphates. In an analogous manner the extremely poisonous sulphids are converted into sulphates which are relatively nonpoisonous. The organic acids and their salts are oxidized to the ultimate degree, producing carbonates, and it is a prominent and important fact that in the latter case the dangerous diminution of the alkalescency by means of these acids is transformed into an increase of alkalescency, since even the bicarbonates are of alkaline reaction. 3. Examples of producing inertia by means of reduction are offered in the case of iodates, chlorates and perchlorates, which are excreted in the markedly less poisonous form of chlorids and iodids. 4. Inertia produced by coupling is one of the most remarkable facts in physiological chemistry. An intimate knowledge of this phenomenon is as imperative for the physician at the bedside as for the chemist intrusted with the chemical analysis of the remains. A poison can unite by coupling: (a) with sulphuric acid (*e.g.*, phenol and cresol); (b) with glycuronic acid (*e.g.*, camphor, borneol, menthol); (c) with glycocoll (*e.g.*, benzoic acid, anisic acid, a part of salicylic acid). 5. Inertia produced by splitting occurs with tannic acid of nutgalls, and with some glucosids (*e.g.*, salicin). 6. Examples of changes peculiar to themselves, as productive of inertia, are offered by the salts of ammonia, which are transformed into urea.

"The liver is the most important organ in producing changes in poisons peculiar to themselves. Coupling occurs partly in the liver and partly in the kidney. Splitting processes take place mainly in the intestinal canal, although the liver must also be considered in this connection.

"For a time it seemed that we were justified in supposing that organic substances could be divided into two well-defined classes, according to their respective actions exhibited within the animal body; the substances of the fatty series were supposed to be destroyed, while those of the aromatic series were not. To-day we know that this does not hold good for all substances; not even oxamid, belonging to the fatty series, a trace of which is oxidized; and tyrosin, a member of the aromatic series, which can be completely transformed into urea, carbon dioxid and water.

"This observation, therefore, can at the present time be stated only in the following form: Organic substances containing annular linkage within the molecule are frequently not oxidized to form carbon dioxid, water, and urea. It is immaterial whether or not they belong to the

aromatic series proper. Substances not containing annular linkage, which are oxidized with difficulty or not at all, are mainly certain amids.

"One of the foremost tasks of scientific pharmacology is to explain the relation between the chemical structure of a substance and its pharmacological action. Unfortunately, it can only be said at present that uniform laws, which would be of great service to the physician, have not yet been discovered. This is neither the time nor place to dilate upon the many interesting structures of such laws."

The lungs, kidneys, and colon are the chief organs of elimination. The liver has a peculiar selective property for certain poisons, such as iron, copper, lead, arsenic, and the alkaloids, nicotin, quinin, morphin, cocain, atropin, hyoscyamin, strychnin, veratrin, and curare. Disturbances in these eliminating organs influence the dose of a poison which may be given with impunity; that is, what would be a normal amount in health, may on account of the disordered condition of these excretory organs, prove harmful and even fatal. Therefore, the practitioner must bear this in mind, lest he should cause symptoms of poisoning when he wishes only the therapeutic action of the drug.

Certain poisonous drugs produce an action upon the human system which is called "cumulative," and this can perhaps be best illustrated by the action of certain poisons, such as arsenic or belladonna. Sometimes the administration of arsenic in medical doses, and which are non-poisonous in ordinary health, will provoke marked local irritation upon the digestive tract, especially upon the mucous membrane of the stomach and intestines; and even when this local action does not occur, the long-continued administration of arsenic may induce fatty degeneration of the liver and also of the other organs. As a result of this degeneration interference with the normal functions may threaten the health. In this latter case the action is due to the drug not being eliminated from the body, and in this way an abnormal condition of the lungs is produced.

Where a fatal dose of poison has been ingested at one time, the symptoms arise more or less suddenly. They, of course, depend upon the rapidity of absorption, the quicker the absorption, the quicker the appearance of the symptoms. Many circumstances may affect the rapidity of the absorption, such as whether the stomach is full or empty and the condition of the mucous membrane, also the health and habits of the individual. On the other hand, the appearance of violent symptoms similar to those of poisoning must not be taken as proof positive by the physician that poison has been taken. If the poison has been swallowed with the food or drink, the symptoms may not occur for some time—an hour or even longer after the food was partaken of; but once the symptoms have begun to appear, there is generally an increasing development of them, which sometimes may be so characteristic as to indicate the par-

ticular poison. Occasionally the symptoms are apparently recovered from only to appear again at a later time, and one must always have this in mind when treating such a case. This is well shown in cases of poisoning by corrosive sublimate. A case personally known was where a girl took four of the ordinary corrosive sublimate tablets, each containing 7½ grains. The treatment was directed to the emptying of the stomach, when more than one-half of the dose was recovered. The patient apparently was making a rapid convalescence from the effects of the poison, when, on the tenth day violent symptoms arose, and she died soon after.

Sudden death is not produced by most poisons, yet acute poisoning is often followed by death soon after the ingestion of a fatal dose of a poison; that is, within a few minutes or hours; although, of course, the patient may survive for several days.

Differential Diagnosis.—The differential diagnosis between the symptoms of poisoning and those of disease is of the greatest importance, and it should be clear enough, not only in the mind of the physician, but the physician should be able to convince the jury if occasion should arise. This is extremely difficult, for while the physician may assure himself of the correctness of his diagnosis, he cannot always say that the symptoms may not be explained by those caused by disease; for example, in strychnin poisoning, convulsions caused by this alkaloid may be attributed to some other cause, if they are taken into account without regard to their number, the rapidity of their appearance, the consciousness of the patient between paroxysms, or other symptoms which are attributable to strychnin poisoning. The same is true of other poisons, especially the irritant poisons. A physician may find it difficult to distinguish between the symptoms produced by irritant poisoning and those of gastro-enteritis caused by some other means. One case is reported where a case of poisoning by arsenic was mistaken for an attack of malignant cholera. The symptoms, among others, were vomiting, cramps, lividity, cold and clammy skin, which usually attend a severe attack of cholera. The convulsions produced by hysteria may be confused with those produced by strychnin, and where one is not familiar with such convulsions a diagnosis of the wrong cause may easily be made. Further, those convulsions that are produced by tetanus itself may simulate those of strychnin poisoning, although here there are more marked differences; first, the interval in strychnin poisoning is characterized by a relaxation, and consciousness is generally preserved between the paroxysms, while in tetanus it is not. Epilepsy has been confused with the convulsions produced by strychnin. Here, the order of the seizures, loss of consciousness, the peculiar clonic movements of epilepsy are entirely different from the convulsions of strychnin poisoning.

There are certain other conditions and diseases which may simulate in their symptoms cases of poisoning, and they demand a few more words in explanation.

Cholera may easily be mistaken for irritant poisoning. In its malignant form it is often rapidly fatal; it may occur shortly after a meal; its onset is marked by decreased bodily temperature, and is often sudden and usually preceded by diarrhea; there is great thirst, vomiting and purging; the surface of the body is cold and the features cyanotic; the pulse is feeble or scarcely perceptible. Postmortem, the appearances are not characteristic, though sometimes there are inflammatory changes in the intestines. The symptoms produced by arsenic are very similar to these, but a chemical examination will, of course, prove the presence of the poison.

The symptoms produced by irritant poisons are a burning sensation in the throat and stomach, pain and distress in the epigastrium, and generally vomiting. The vomitus later consists chiefly of mucus which is more or less bloody, and is not ejected as in cholera, but is accompanied by distress and effort. The prevalence of the disease in a locality, of course, will enable the physician in many cases to draw a correct diagnosis.

Cholera morbus has more points of resemblance than cholera to cases of poisoning. In this disease the extreme collapse and characteristic discharges are not seen; but on the other hand, vomiting and purging are generally present and there is pain in the abdomen. This pain, however, is intermittent in cholera morbus, and the vomiting is less frequent and painful, whereas in poisoning the pain is usually sudden and there is pain upon pressure; the vomitus consists of blood and mucus and the feces are of similar character. Cholera morbus is rarely fatal, whereas these symptoms produced by irritant poisons tend to death.

On the other hand, in those fatal cases of cholera morbus which occur occasionally, life may be prolonged, and the symptoms be similar to those produced by the administration of an irritant poison, followed immediately by death. Irritant poisons, as a rule, leave behind them postmortem appearances which are fairly characteristic and which should prevent their being mistaken for those of disease, even in those cases which are of criminal intent, though not suspected at the time.

Certain accidents may cause symptoms similar to those following the administration of irritant poisons, such as rupture of the stomach, intestines, or uterus, but postmortem such conditions are easily recognized and are not confused with the appearances caused by poisoning. Postmortem rupture of the stomach must be carefully distinguished from that occurring during life. In the latter condition there are usually symptoms of inflammation of the stomach and peritoneum. In cases

of poisoning, perforation of the stomach is rarely caused except by corrosives, and where this perforation is due to such action, there are evidences of the action of the poison upon the throat, esophagus, and stomach, as well as upon the mouth and lips. The stomach in such cases is black and extensively destroyed; the edges of the opening are rough and irregular and there is an escape of the contents into the peritoneum, which contents must be examined chemically for the poison. In cases of perforation due to other causes, such as cancer and ulcer, the opening is "characteristic." "The aperture is usually of an oval or round form, about ½ inch in diameter, situated in or near the lesser curvature of the stomach, and the edges are smooth. Indeed, it has not unfrequently the appearance of being 'punched out.' The outer margin of the aperture is often black, and the aperture itself is funnel-shaped from within outwards; *i.e.*, the mucous coat is the most removed, and the outer or peritoneal coat the least. The coats of the stomach around the edge of the aperture are usually thickened for some distance; and when cut they have an almost cartilaginous hardness" (Taylor). Death in these cases takes place from peritonitis from infection through the stomach. Similar perforation may occur in the duodenum or the upper portion of the small intestine. Usually they are the result of ulceration or cancer.

Postmortem perforation may occur where the digestive process has gone on after death; it occurs, as a rule, only at the cardiac end of the stomach; the opening is large and irregular, more or less "moth-eaten", and is not surrounded by inflammation. There is no peritonitis and, to quote from Budd, "it is not very uncommon during the hot weather. During the past summer, which was a very hot one, my attention was casually drawn to this subject, and from the middle of May to the middle of August I carefully examined the stomach in all the bodies that were opened in King's Chapel Hospital. In several instances the mucous membrane of the stomach, in the greater curvature, was completely destroyed, and in a very large proportion it had been clearly acted upon more or less by the gastric juice. I renewed my observations in October, and the change, in a striking degree at least, was then much less frequent."

If there is any question whether the perforation was caused by postmortem changes or by the corrosive action of some poison, it can be easily determined by chemical examination.

Gastritis and gastroenteritis are often symptoms of poisoning, especially by the irritant poisons. When due to the other causes they are generally of a different nature. Simple gastritis, as a rule, is of longer duration than when due to irritant poisoning, and diarrhea is not always present, though it usually accompanies irritant poisoning. Gastro-

enteritis and peritonitis are accompanied by fever, which is generally not present in cases of poisoning, especially in the early stages.

Apoplexy, epilepsy, and cerebral congestion may produce symptoms similar to those caused by the narcotics. Apoplexy usually does not occur under the age of thirty or without warning symptoms and, as a rule, the conditions are independent of the taking of food or drink. The symptoms produced by apoplexy are almost immediate in their appearance, while those produced by narcotics are gradual and the stupor is generally preceded by drowsiness. The pupils also may furnish evidence of the administration of opium, and hemorrhage into the pons varolii may be mistaken for opium poisoning on account of the conjunction of insensibility with contracted pupils (Luff). In most cases of apoplexy the attack is sudden, and the patient cannot be aroused; the pupils are dilated and insensible, and the face may be somewhat distorted on account of the paralysis affecting only one side of the body. Of course, where there is any doubt, the postmortem examination will clear up the case, and if need be, chemical investigation may be employed to confirm this.

Embolism, on account of causing sudden death, may be mistaken for poisoning, but this can easily be determined postmortem if there is any doubt.

Pneumonia may cause the victim to fall suddenly in the street, unconsciousness supervene, coma, and death, and here we may suspect the administration of some fatal poison. In such a case postmortem examination is of very great importance.

Cerebrospinal meningitis generally occurs as an epidemic and is more frequent in the cool months than it is in the summer months. The disease is characterized by the sudden onset of chills, accompanied by very severe headache, and, as a rule, by vomiting. In a day or two, the head is generally retracted, the headache continues, and the pain extends down the back of the head and along the spine. The opisthotonos increases, consciousness is lost, and sometimes constipation, though occasionally diarrhea, continues throughout; the urine is often suppressed or retained. The postmortem appearances are very marked, especially if the patient survived several days. If the patient dies immediately the postmortem appearances may not be noticeable, and resort may be had to chemical analysis.

The distinction between the convulsions of tetanus and those of strychnin have already been referred to. The symptoms produced by one poison may be opposite to those produced by another, and this often plays an important part in toxicology. This similarity does not imply that the poisonous dose of one drug may cause death as a result of the administration of another drug; for example, a nonfatal dose of strych-

nin may combat the symptoms produced by a fatal dose of chloral, provided the strychnin is given first. On the other hand, the administration of strychnin to a patient already suffering from a poisonous dose of chloral may hasten a fatal result.

Dr. Harrison reports a case where about three-fourths of a grain of strychnin and 90 drops of laudanum were given. In three-quarters of an hour the strychnin convulsions appeared; during this time some urine, a portion of that passed, was collected and examined, and showed the presence of about $\frac{1}{20}$ grain of strychnin. Chloral was used as an antidote for strychnin, and the man recovered. Another case where a similar amount of strychnin was given with 2 drams of laudanum and some mercuric oxid no convulsions occurred, but the man exhibited marked narcosis which gradually disappeared. Another, where a patient took 10 grains each of strychnin and morphin. The postmortem examination proved death due to a cerebral condition caused by uremic poisoning from serious renal disturbance. Symptoms of morphin poisoning were hardly recognizable.

The blood may have absorbed so much of one poison that the second cannot be absorbed until the first has been eliminated. Often, in these cases, the symptoms of the two drugs are marked; for example, a dog was etherized, and then a dose of hydrocyanic acid, twice that required to destroy its life, was administered subcutaneously. In three-quarters of an hour, while the ether was being inhaled, there was no evidence of poisoning by prussic acid, but on allowing the dog to recover from the etherization the symptoms of prussic-acid poisoning appeared, and the animal died. Langley says: "Alkaloids act on the tissues by forming chemical compounds with them. When two poisons act on the same tissue, the result depends on their relative physiological or chemical affinity for the tissue, and the mass of each present. Thus, then, within certain limits to be spoken of presently, if the one alkaloid is given its effect can be antagonized by giving a sufficient quantity of the other. A limit is placed to this antagonism by the impossibility of giving very large quantities of any substance without injuring the tissue by physical processes consequent on alteration in the density of the fluids. The antagonistic action of alkaloids can only occur within the limits of doses which do not seriously alter the tissue by altering the normal rate of diffusion, etc. If, for instance, a nearly maximal dose of atropin be given, no other alkaloid we are acquainted with can antagonize its action on the salivary glands, for the chemical affinity of atropin for the tissue is so great that it would require, to compensate for this, a mass of the other alkaloid impossible to be given without direct injury to the tissue."

Antidotes.—This brings up the subject of various antidotes which are to be used in cases of poisoning; and while there is much to be said

in favor of this it should not be forgotten that the ignorant use, or even abuse of the antidote, may increase the danger to life. In those cases it is of special importance that we are sure what poison has been swallowed. The use of the stomach-pump after caustic poisons have injured the tissues by contact with the mucous membranes of the throat and esophagus is certainly not to be recommended, nor is it advisable to administer an irritant emetic.

Classification of Poisons.—Poisons have been divided into various classes by different authors, but none of these classifications is entirely free from objection. Some have classified them according to the kingdom from which they are derived, into mineral, animal, and vegetable. Others, according to their chemical properties, into organic and inorganic, acids, alkalies, and salts. Others into classes based upon their physiological action. Still others, especially Orfila, into irritants, narcotics, and narcotico-irritants. None of these classifications can be absolutely adhered to, since some poisons may be irritating in their chief action, and yet at times produce narcosis. Others may be narcotic generally, and still cause symptoms of irritant poisoning. Of these various classifications, Taylor's, which is based upon the physiological action, is perhaps as good as any. But in this treatise we shall not adopt any such classification, but shall divide the poisons into groups, which from their chemical and physical nature, are those which are ordinarily employed by the chemist in his investigation. The most desirable classification would be one based upon the action of the various poisons, but therapeutics is not sufficiently advanced as a science to render this possible with the desired certainty. A classification based upon the origin of poisons has its disadvantanges, but they are not so great as those which occur in attempting to classify poisons by their action.

A classification based upon the chemical and physical properties, together with their nature and origin to a certain extent, seems to us at present the most desirable, but undoubtedly with the future advance of science it may be subject to change. In Group I, we shall place the gaseous poisons, such as carbon monoxid, sulphid of hydrogen, etc. In Group II, the inorganic chemical compounds, which are poisonous, and in Group III, organic chemical compounds, which are not the active principles of plants containing nitrogen—that is, are not alkaloids. In Group IV, alkaloids, and in Group V, those bodies whose chemical composition is not sufficiently understood to permit us as yet to classify them as organic poisons.

CHAPTER II.

GASEOUS POISONS

CARBON DIOXID

This is one of the commonest gases, as it is of universal occurrence, being abundantly produced by a large number of natural and artificial processes, such as the respiration of all animals, processes of decay, alcoholic fermentation, and combustion of wood and coal, etc. It is a heavy gas (sp. gr. 1.52) as compared with air, and is therefore apt to be found in greatest quantity near the floor after combustion has ceased.

Carbon dioxid, often incorrectly called carbonic acid, is not directly a poison, but can be considered one indirectly in that it may cause death by depriving the system of oxygen and thus causing death by asphyxia.

Most of the accidents caused by coal gas, confined air, vapors from vats and other confined spaces, such as caves, old wells, cisterns, etc., are undoubtedly, in a large measure, attributable to poisoning not by carbonic acid, but by carbonic oxid, sulphid of hydrogen, or other gases which have their origin from such sources, but which as yet are little known.

Carbon dioxid is irrespirable. It is, however, unlike nitrogen in this respect, and is more injurious because it prevents the inspiration of oxygen and the respiratory functions. Nitrogen and hydrogen cannot supply the deficiency of oxygen and cause normal changes in the blood necessary to support life. Whereas, with carbon dioxid the hemoglobin of the blood forms a chemical compound interfering with the interchange of oxygen.

If pure carbon dioxid is inhaled, the glottis closes and prevents further inspiration, the head becomes crowded with a sensation of ringing in the ears, vertigo, and loss of consciousness. If the inspiration is continued asphyxia supervenes, from which the patient may die if the inspiration is continued. The local action of carbon dioxid on the skin is that of an anesthetic. It has long been known that the ciliary movements are stopped by this gas. Death after continuous inspiration of carbon dioxid is probably caused by lack of oxidation.

Symptoms.—These are either immediate or gradual, according as to

whether the gas is inhaled in large quantities with the exclusion of oxygen or is inhaled in atmosphere more or less charged with carbon dioxid. In the gradual form of poisoning there is a tendency toward giddiness and loss of muscular power; profuse perspiration and nausea are not uncommon. Some loss of muscular power is often illustrated in those accidents that are the most frequent causes of death by this poison. When the gas is in considerable quantity in the atmosphere inhaled, there is also a sensation of great weight in the head, of singing in the ears, of pressure in the temples, and there is often a strong desire to sleep. If erect, the person falls to the ground as if struck; the body collapses, the head falling on the breast. Convulsions may supervene, but not when there is a sufficiency of oxygen present. The action of the heart is at first increased, and then becomes slower, finally ceasing.

Treatment.—The body should be removed as speedily as possible to fresh air, and if necessary the inhalation of oxygen practiced. Cold sponging, electricity, and friction may also be used. Resuscitation may take place even after the person has been insensible for a long time.

Postmortem appearances are those of asphyxia; sometimes the face is livid and swollen, but not infrequently pale. The position of the body usually indicates that the person has died without a struggle. The venous system and the right side of the heart are often filled with dark venous blood and there is congestion of the lungs and brain. Death in such cases might easily be attributable to apoplexy or some other cause.

Tests.—The air of a room contains an undesirable amount of carbon dioxid if an ounce of lime-water becomes turbid when shaken with 8 ounces of bottled air, that is about 1/10 of 1%. When the quantity reaches 5/10 of 1% most persons are affected with headache, and with 8% suffocation ensues. The ordinary tests for carbon dioxid in confined spaces is the dimming of a candle flame, which should warn persons against entering such spaces. The flame is extinguished when the proportion is about 15%.

CARBON MONOXID

The most common occurrence of this gas is its production in the combustion of coal. When coal or coke is burned with an insufficient amount of oxygen, carbon monoxid is formed in large quantities. When the supply of oxygen or air is sufficient, carbon dioxid is formed in larger quantities, and the amount of carbon monoxid is considerably lessened. At present large quantities of carbon monoxid are produced in the manufacture of ordinary illuminating gas in large cities. In Europe carbon monoxid is one of the most common agents for suicide. In England and the United States this agent is seldom used, but acciden-

tal deaths from gases escaping from burning coal or the smothering combustion of wood are quite common. In recent years however, suicides from the inhalation of illuminating gas seem to be on the increase.

Ordinary illuminating gas, consisting chiefly of light carburetted hydrogen contains also vapors of volatile liquids, carburets of hydrogen, carbon monoxid and other elements. Light carburetted hydrogen is in itself hardly poisonous, but the composite gas which is now so freely used for heat and illumination frequently causes fatal accidents. The danger arising from the inhalation of illuminating gas varies with the amount of gas and with its purity, the most dangerous factor being the amount of carbon monoxid it contains. Ordinary illuminating gas of good quality consists of hydrogen (40–50%), marsh gas (35–40%), carbon monoxid (4½–7½%), and various hydrocarbons (4–8%), with usually a small amount of carbon dioxid and air. So-called water gas, which is made by passing steam over white hot coal, yields a gas which burns with an almost colorless flame and contains a large amount of carbon monoxid. When this is mixed with a highly luminous gas, such as made from naphtha or petroleum to give it illuminating properties it still contains large quantities of carbon monoxid, and this carbon monoxid is the factor which is so active in causing death.

Properties.—Carbon monoxid is a colorless, almost odorless gas, practically insoluble in water. It burns with a pale blue flame, and is lighter than air, having a sp. gr. of 0.967.

Symptoms.—Warm-blooded animals compelled to breathe mixtures of air and carbon monoxid show an increase in arterial pressure, followed later by a decrease in arterial pressure. The surface of the skin becomes mottled; the respiration and the circulation become slower, finally ceasing. In man similar symptoms occur, often preceded by headache, vertigo, and loss of voluntary muscular action, sometimes by convulsions. The temperature of the body is lowered and there is contraction of the voluntary muscles. Recovery is rapid, as a rule, if the patient is placed where he can breathe pure air and if oxygen is administered. Often there is a state of maniacal excitement, during which the patient may be dangerous to those about him.

Carbon monoxid has a direct action on the nervous system when an atmosphere with at least 20% of carbon monoxid is inhaled. First there are acute cramps or total paralysis of the limbs. Gangrene is mentioned by many writers as a sequela of carbon monoxid intoxication, and both sugar and albumin are often found in the urine.

Treatment.—The patient should be removed where he can breathe fresh air. One of the most important objects should be to keep the surface of the body warm in order to promote active circulation through the blood-vessels of the skin and extremities. Respiration should be

actively encouraged and, if necessary, artificial respiratory motions performed. The best stimulant to excite the heart is carbonate of ammonia in weak solution.

Postmortem Appearances.—After poisoning by carbon monoxid the blood becomes a peculiar cherry-red color, and remains fluid much longer than usual. The skin of the face, neck, and trunk shows irregular patches which are not postmortem ecchymoses, because they are usually observed before death and persist afterward. The countenance is placid and calm, especially where the inhalation was continued for some time. Putrefaction is often delayed for a long time after death.

Examination.—The detection of this form of poisoning depends chiefly upon the recognition of carbon monoxid in the blood by means of the spectroscope. In cases of poisoning by carbon monoxid or any gaseous mixture containing it, the blood has a bright-red color which is very persistent. This color is due to the union of the blood pigment, hemoglobin, with carbon monoxid which has replaced the oxygen normally combined with the hemoglobin, thus depriving the blood of one of its most important physiological functions—that is, of furnishing oxygen to the blood.

Tests.—The most reliable test for the presence of carbon monoxid is its action upon hemoglobin. When examined by means of the spectroscope the oxyhemoglobin shows the presence of one or two absorption bands, according to the dilution. If the solution is concentrated, the only light transmitted is in the orange, the rest of the spectrum being absorbed. If this solution is dilute, two bands appear; with further dilution, one of these bands disappears. With mild reducing agents, as Stokes' reagent, the two bands mentioned above coalesce, forming one broad band which generally has not sharply defined edges, and occupies the space between the two bands of oxyhemoglobin. With carbon-monoxid-hemoglobin solution in proper dilution, two bands are seen in almost the same position as those of oxyhemoglobin, but easily distinguishable from them by remaining unchanged on the addition of reducing substances to the solution. Carbon-monoxid-hemoglobin is reduced with great difficulty and only on long standing, whereas oxyhemoglobin is easily reduced to hemoglobin under the same conditions.

SULPHID OF HYDROGEN

Sulphid of hydrogen, or sulphuretted hydrogen, is formed in the putrefaction of organic matter which contains sulphur as well as in the living body, especially in the intestines. Vegetable and organic matter, such as occurs in sewers and cess-pools, may give rise to the formation of considerable quantities. Anaerobic bacteria produce gas from decaying vegetable matter in ponds and lakes. It is a colorless

gas, heavier than air, sp. gr. 1.19, of a peculiar nauseating odor, is quite soluble in water, has an acid reaction, and is combustible, burning with a blue flame.

This is the principal of the poisonous gases which are evolved from privy wells and foul drains. Its odor is so extremely offensive as to prevent a person from inhaling it unless obliged to, so that accidents seldom occur from it.

Symptoms.—The first symptom is often a smarting sensation of the eyes, which is followed by difficult breathing, cough, palpitation of the heart, muscular weakness, and faintness. For the local irritation the symptoms are generally those of convulsions, and death occurs from pulmonary inflammation, accompanied by paralysis of the nerve-centers. Occasionally the symptoms are similar to those of typhoid fever. Sugar has been found in the urine in certain cases.

Chronic Poisoning.—This is most apt to occur to laborers working in sewers, who come in frequent contact with sewer gas. The most common symptoms are inflammation of the conjunctivæ, headache, and often digestive disturbances. Like carbon monoxid, hydrogen sulphid has a special action upon the hemoglobin of the blood-corpuscles, and its compound called sulph-meth-hemoglobin can be recognized by the spectroscope.

Postmortem Appearances.—When death has taken place suddenly no special postmortem signs are observed. After chronic poisoning, however, there is edema of the lungs and usually an early appearance of the postmortem green discoloration over the whole surface of the skin, including the face and neck, similar to that which is often observed after death from any lingering disease. The postmortem discoloration of the blood in cases of sulphid of hydrogen poisoning is, unfortunately, not peculiar enough to be of much medico-legal value, inasmuch as we often have the formation of sulph-meth-hemoglobin from decomposition of the tissues after death by other causes. The detection of sulphid of hydrogen, in cases where it has caused death, is not particularly easy for the above reason. On the other hand, certain tests which can be readily applied are of more or less value. Its odor is very characteristic and can be detected in very great dilution (1–1000). The gas passed through a dilute solution of lead acetate will give a brown precipitate, or where only traces are present merely a coloration. Arsenic in acid solution will give the yellow precipitate of sulphid of arsenic. Sulphuretted hydrogen solution when treated with concentrated hydrochloric acid and a pinch of para-amido-dimethyl-anilin sulphate and a drop or two of dilute ferric chlorid solution gives a blue color on standing.

CHAPTER III.

INORGANIC POISONS

BORIC ACID

Boric acid is a white, crystalline substance, with a slightly bitter taste, odorless, soluble in water, and often used as a preservative. The United States Agricultural Department at Washington has investigated the subject of its injurious action by experiments upon the human being with food products into which this agent was introduced. Their results are set forth in Circular No. 15, which is a digest of Bulletin No. 84. The results as embodied in the circular conclude as follows: "It is, of course, not to be denied that both borax and boric acid are recognized as valuable remedies in medicine, and there are certain diseases in which these remedies are regularly prescribed, both for internal and external use. The value which they possess in these cases does not seem to have any relation to their use in the healthy organism except when properly prescribed as prophylactics. The fact that any remedy is useful in disease does not appear to logically warrant its use at any other time. It appears, therefore, that both borax and boric acid, when continually administered in small doses for a long period or in large quantities for a short period create disturbances of appetite, of digestion, and of health."

Cases of poisoning by boric acid are extremely rare, although one case is reported in England.

Tests.—Borax or boric acid can be detected by fusion with sodium carbonate or sodium nitrate, the fused mass extracted with alcohol and sulphuric acid; the alcohol on ignition burns with a green flame which can be recognized by its spectrum.

Borates with hydrochloric acid stain turmeric paper reddish-brown; potash changes this color to a blue-black.

Its detection in organic mixtures is rather difficult on account of its volatility. Organic mixtures of it can be dried in vacuum over sulphuric acid and then fused with potassium carbonate and nitrate.

HYDROCHLORIC ACID

Hydrochloric acid is largely used in the arts and manufactures, in many bleaching processes and, to a certain extent, in medicine. It is a

colorless gas (sp. gr. 1.26), very soluble in water and with an acid taste and reaction. Ordinarily, we meet with hydrochloric acid in an aqueous solution of varying strength and purity. It is often known as muriatic acid or spirits of salts. The acid in strong solution gives off dense white fumes which are distinctly visible, especially in moist air and in the presence of ammonia, the latter forming ammonium chlorid.

Symptoms.—This acid is not used to any considerable extent as a poisoning agent, as the cases of poisoning by its use are not numerous. The symptoms caused by poisoning by hydrochloric acid are very similar to those of sulphuric acid, except that on account of its volatile nature its fumes are distinctly more irritating than those of the other acids, and may cause inflammation of the glottis and throat. Where the acid has been swallowed there is a burning sensation from the mouth to the stomach, generally followed by severe and continuous vomiting; the respiration becomes more frequent and labored, later followed by feeble pulse and exhaustion. Rarely perforation of the stomach may ensue from the action of the acid upon the gastric mucosa.

In those cases where the patient may survive the immediate symptoms of poisoning there is apt to occur inflammation which may produce stricture in the throat or trachea, interfering with respiration and the swallowing of food. As a rule, a fatal termination is to be expected, but in those few cases where death has not supervened within the first few days the patient may suffer from its effects in the way of poor general health, and disturbances of the digestive tract.

Diagnosis.—The recognition of hydrochloric acid as the cause of the above symptoms is often extremely difficult. A chemical analysis is unsatisfactory in that hydrochloric acid being a constituent of the normal gastric juice, its detection in the gastric contents is only of value when done quantitatively. Unless there is found a large increase in the per cent. of hydrochloric acid or chlorin ion in the stomach contents, it could hardly be considered of itself to denote that this acid had been used.

Tests.—The tests for the detection of combined hydrochloric acid are those ordinarily employed in qualitative analysis.

Nitrate of silver produces a white precipitate of silver chlorid which is soluble in ammonium hydrate or potassium cyanid solution and insoluble in dilute nitric acid.

Mercurous nitrate produces a white precipitate of calomel which is blackened by the addition of ammonium hydrate.

Lead acetate produces a white precipitate of lead chlorid, which is slightly soluble in cold, freely soluble in hot water, and may be easily crystallized from the latter.

As common salt is almost always present in the stomach and is a

normal constituent of many of the body secretions, the simple detection of hydrochloric acid or halogen gives no indication of the manner in which it was introduced. A quantitative determination of the free mineral acid present should always be made.

HYDROFLUORIC ACID

Fluorin is a normal constituent of many animal tissues, sometimes to a considerable extent, so that its detection is not a positive proof of any medico-legal importance. Cases of poisoning by this acid are very rare.

NITRIC ACID

Nitric acid is often met with in commerce and in the manufactures. When pure it is colorless, but the commercial acid varies from a light yellow to an orange-red, especially if it has been exposed to the sunlight. It produces a yellow stain upon the skin or mucous membrane, which is intensified to an orange by the application of an alkali. Cases of poisoning by nitric acid are much rarer than those by sulphuric acid, as the former gives off a peculiar irritating odor which permits its detection before taken into the mouth. The fumes of the strong acid are poisonous when inhaled and may cause serious injury to the air-passages.

Symptoms.—When nitric acid comes in contact with the skin there is produced a yellow stain which does not disappear upon the addition of ammonia, but rather is changed to an orange color. In contact with the mucous membrane of the mouth there is observed a similar yellowish stain, as well as upon the mucous membrane of the stomach. The corrosive action produced does not vary essentially from those mentioned under sulphuric acid. There is intense burning pain in the mouth, throat, and stomach, vomiting and other constitutional symptoms. The air-passages are very apt to be affected by the volatile fumes of this acid. The vomitus is often yellow rather than black or brown, as is the case with sulphuric-acid poisoning.

If the patient survives the first acute symptoms of poisoning by this acid, stricture of the air-passages and esophagus may result from secondary inflammation; and death may later occur from injury to the digestive tract.

Fatal Dose.—The mimimum dose as far as recorded is two drams. Death has occurred from the inhalation of the fumes alone.

Treatment.—The stomach-tube should not be used. Neutralization of the acid should be first attempted, followed by fats, oils and demulcent drinks, and temporarily it may be necessary to resort to rectal feeding until the stomach and esophagus have recovered from the injury done them.

Tests.—Nitric acid, unlike sulphuric and hydrochloric acids, is not a normal constituent of the animal economy, so that its detection is much easier than that of these two other acids. Nitric acid when free can be detected by the following tests: Ferrous sulphate in aqueous solution gives a brown ring on the addition of a nitrate and sulphuric acid.

Anilin sulphate gives a purple or violet color when used in this way. Brucin or a solution of a salt of brucin gives an orange color with nitric acid. A bit of copper introduced into a solution containing nitric acid will be dissolved, forming a greenish-blue solution, and red fumes will be evolved.

Where organic mixtures, such as stomach contents or vomitus, are to be tested for the presence of nitric acid, the strong acid reaction and the odor of the nitrous fumes will seldom leave any doubt as to its presence. Calcium carbonate (chalk) mixed in excess with a solution to be tested for nitric acid forms calcium nitrate and this can be isolated and identified by the above tests.

NITROHYDROCHLORIC ACID

Nitrohydrochloric acid consists of 18 parts of nitric acid, and 82 parts of hydrochloric acid. It is often known by the names of "nitro-muriatic acid" and "aqua regia." It is a light yellow-colored, fuming liquid, with a very corrosive action and a strong odor of chlorin. This acid contains free chlorin, so that when it is taken internally there is in addition to the action of both acids which are its component parts, the further action of chlorin which is an extremely corrosive gas, especially to the respiratory tract.

SULPHURIC ACID

Sulphuric acid is widely used in many manufactures and in the arts, and almost all chemical processes involve its use in some form or other. It has been used often by the poorer classes as a suicidal agent, where difficulty was experienced in obtaining other poisons. It is an oily, colorless liquid when pure, having a sp. gr. of 1.84, and extremely bitter. It dissolves many of the common metals with the evolution of hydrogen gas. The sulphuric acid of the Pharmacopeia, also known as hydric sulphate, oil of vitriol, occurs as a "colorless liquid, of an oily appearance, strongly caustic and corrosive, and having a strongly acid reaction. Its sp. gr. should not be below 1.840. It is miscible in all proportions with water and alcohol, with the evolution of heat."

Symptoms of Poisoning.—Local.—Sulphuric acid in its concentrated form precipitates albumin and later dissolves it. Muscular tissue is first colored a light brown, becomes swollen, and then dissolves to a dark brown or reddish fluid. When sulphuric acid comes in contact

with the lining membrane of the stomach, the mucosa as well as the muscle layers beneath are colored white, swell, and become an oily mass. The changes that sulphuric acid cause in the blood are as follows: the fibrin is at first coagulated and later dissolves, and the coloring matter turns black. It is thus seen that sulphuric acid exerts a very corrosive or caustic action similar to other mineral acids, and in this way they act as poisons.

Sulphuric acid is often taken or given by mistake rather than by design, although in Europe it has been used as an agent to kill children. It is easily procured on account of its extensive use, and is often taken with suicidal intent. Sulphuric acid may be taken as a type of corrosive poisons, the symptoms varying, of course, according to the concentration and the amount taken. With a large dose of the strong acid the symptoms are almost immediate and are characterized by a very acute pain which at first is that of burning. The abdominal pain is very excruciating, similar to that of cholera at times. Violent vomiting occurs almost immediately, the vomitus consisting of black or dark brown material of tarry consistency and very acid, often frothy, and mixed with shreds of detached mucous membrane. The character of the contents of the stomach has considerable influence upon the period at which death may occur, as well as upon the extent of the corrosion of the tissues, *e.g.*, if the stomach is full, especially of milk, albuminous foods or fats, they will probably offer considerable protection to the mucosa, whereas if the stomach is empty the action will be much more violent and severe, and this difference in condition accounts for the wide diversity in results in poisoning by this agent. If the acid comes in contact with the larynx or the mucous membrane of the respiratory organs, it is apt to cause edema of the glottis and death from suffocation. In those cases where death has been prolonged from 12 to 24 hours, as is usually the case, collapse soon supervenes. The urine may be entirely suppressed due to the action of the acid upon the kidneys. There may be diarrhea, although, as a rule, there are no fecal movements. Sometimes convulsions are present. Usually we can detect on inspection local evidences of the acid upon the face, the mouth, often also upon the neck and clothing.

Subacute Poisoning.—When the dose of sulphuric acid is small or taken upon a full stomach, or when only dilute acid has been used, the symptoms are much less severe, as a rule. In these cases life may be prolonged for a considerable time. Hemorrhage may be lacking as well as the bloody vomitus, although the vomitus, as a rule, contains a great deal of mucus, and there may be more or less pain in the mouth, throat, and stomach. Often when the patient's life is spared until the eschars caused by the acid are healed, there will result cicatrices which

may result in strictures of the esophagus or stomach followed by dyspepsia, indigestion and perhaps death from starvation.

Fatal Dose.—An exact determination as to the amount necessary to produce death varies so much with the conditions of the case that it is hard to give a definite statement. A case is on record in which twenty drops of the concentrated sulphuric acid caused death in a child twelve months old. Another case where sixty grains killed an adult, which is the smallest lethal dose reported. The strength of the acid administered and the fact whether the stomach is full or empty alter the conditions a great deal. Usually the intense corrosive action is such as to cause one involuntarily to try to get rid of rather than swallow it, so that it often happens that only a small part of that taken into the mouth actually reaches the stomach.

As a rule, death takes place within 12 or 24 hours, although often the edema of the air-passages that is caused produces suffocation and the patient dies immediately. In the milder cases life may be prolonged a week or even two weeks. In chronic cases it may be prolonged for years even, death occurring, as a rule, secondary to the injuries to the digestive tract or to inanition.

Treatment.—Efforts should first be made to neutralize the acid by some alkali like magnesia, chalk, or sodium carbonate, although these two latter should only be used fairly dilute, and are objectionable because so much carbon dioxid is formed that it is distressing to the patient. If nothing better is at hand, plaster can be torn from the ceiling, as the sooner the acid is neutralized the better. Tracheotomy may be necessary to prevent suffocation.

Detection.—As a rule, it is difficult to determine by chemical tests that sulphuric acid, as such, was administered. The reason for this is that sulphates form a certain proportion of our daily food, and the presence of sulphates alone is no indication of poisoning by sulphuric acid, and further, where alkalies have been used to neutralize the acid there may not be a distinctly acid reaction to the contents of the stomach. It may be often necessary to make a quantitative estimate of the amount of sulphuric acid present, and if it is largely in excess of the normal, it forms a presumption in favor of the view that sulphuric acid was ingested, so that the chief evidence must be obtained rather by the symptoms during life and by the postmortem investigation than from chemical analysis. Stains on clothing will often suggest the presence of sulphuric acid. On blue or black clothing these stains are first red, afterward brown and later the stuff becomes corroded. With strong acid these stains become brown at once. The stains on textile fabrics generally remain moist for some time, especially if the acid used was concentrated.

ALKALINE CAUSTICS

Potassium hydrate is a grayish-white amorphous substance, freely soluble in alcohol and water, and its solution has a soapy feel and a strong alkaline reaction. *Sodium hydrate* is similar to potassium hydrate in most of its properties. *Sodium carbonate*, in distinction from *potassium carbonate* which is deliquescent, is efflorescent. *Sodium carbonate* is commonly known as sal soda or washing soda. It is a crystalline substance, freely soluble in water, with a strong alkaline reaction. The action of all of these substances is similar. Poisoning by any of these substances is very rare.

When swallowed in large quantities and in strong solution, the taste is extremely nauseous and disagreeable, with a sensation of burning and constriction in the throat, esophagus and stomach. When the dose does not produce immediate fatal results or corrosive action, the patient very often has gastric catarrh or inflammation of the mucous membrane, resulting later in constriction of the esophagus, which interferes with deglutition and thus causes death by inanition. Potassium carbonate has a similar action to potassium hydrate, but not so powerful.

Treatment.—The stomach-pump should never be used where the alkalies have softened the tissues of the mouth, throat, or stomach. It is better to neutralize the caustic action of the alkali by very dilute acid, such as vinegar, lemon juice, or tartaric acid.

The chemical **detection** depends upon finding large quantities of the alkali in the vomitus, gastric contents, or food examination. Inasmuch as many of the articles of food and medicine and the constituents of the animal economy contain alkalies it is necessary to isolate them in their original form, free from chlorids and other neutral salts.

Sodium hydrate and carbonate are chiefly recognized by the strong alkaline reaction, the intense yellow color imparted to the colorless flame, and by the absence of potassium or ammonium compounds.

ALUM

Alum is extensively used in the arts and manufactures, especially as a mordant in calico printing and in dyeing. It has been used to whiten bread made from poor quality flour, but such use is undesirable, especially from a hygienic point of view, although it is extensively used in baking powder, and apparently without serious injury to the system. It is usually met with in the form of potassium alum, forming transparent octahedral crystals which are soluble in water. The sodium, ammonium and other alums are also known.

Those few cases of poisoning which have been reported show that its action is that of a local irritant or corrosive. When taken in large amounts it produces almost immediate vomiting, and is often used,

combined with some other emetic, medicinally, where it is desired to promptly empty the stomach of its contents.

Symptoms.—Vomiting almost immediate and persistent; pain over the region of the stomach, and a feeling of constriction and burning in the mouth, throat, and stomach. The pulse is small and frequent, respiration rapid, and repeated attacks of syncope. The urine is bloody and contains hyalin casts.

Treatment.—Washing out the stomach and the administration of demulcent drinks, milk, etc.

Baking Powder.—Mr. Blyth, who does not consider that the danger of poisoning by the use of alum mixed with baking powder is great, sums up in the following words: "Alum baking powders containing 30–40% of alum mixed with bicarbonate of soda are in commerce and have been for a long time, many tons being used yearly. When water is added to such powder decomposition takes place, the result being sodium sulphate and aluminic hydrate, carbonic acid being given off."

Tests.—Soluble aluminum salts on the addition of sodium hydrate gives a white flocculent precipitate, soluble in excess of the reagent. Ammonium hydrate gives a similar white precipitate, but this is insoluble in excess of ammonia, especially in the presence of ammonium chlorid.

Sodium phosphate gives a heavy precipitate of aluminum phosphate which is insoluble in excess of sodium or potassium hydrate. This precipitate is soluble in mineral acids, but not in acetic acid.

AMMONIA

Ammonia gas is colorless, with a burning, irritating, pungent odor, an alkaline reaction to moist test-paper, and easily soluble in water. It is very irritating to the mucous membrane of the nose and throat and air-passages. Concentrated solutions of the gas have similar properties.

Action.—There are a few cases where ammonia gas has caused death. The symptoms are generally those of collapse, accompanied by serous and bloody diarrhea, bloody vomiting, and excruciating pain in the abdomen. The effects produced by swallowing a solution of strong ammonia are similar to but more intense than those of the other alkalies.

Should death not occur within one or two days after taking the poison, we would probably have a set of secondary symptoms as the result of the action of ammonia.

Postmortem Appearances.—Ammonia irritates the respiratory organs, and edema of the glottis often occurs. Croupous exudation may be found in the air-passages, but in other respects it causes lesions like other alkalies. The affected portions gradually become a pultaceous mass of a black color. The postmortem appearances which are found

in the intestinal canal are still more extensive than those observed in the case of sulphuric acid. Purulent inflammation may be observed, the partial healing of which may have caused constriction of the esophagus.

In cases of poisoning by ammonia or its compounds **examination** must be begun as soon as possible, on account of the formation of ammonia and ammonium compounds by the putrefaction of the tissues. In fresh cases it can be easily recognized by its odor, and by the white fumes which are evolved from a glass rod moistened with dilute hydrochloric acid when brought near the fluid to be tested, also by the alkalinity of the vapor from the material itself by bringing near to it a bit of moistened red litmus or turmeric paper. Platinic chlorid moistened with hydrochloric acid, and held near a solution giving off ammonium fumes, yields crystals of ammonio-platinic chlorid which can easily be identified under the microscope. For detecting ammonia in the presence of organic mixtures it is best to mix the material with alcohol, and then after the addition of sodium chlorid distill the ammonia off. The addition of alcohol tends to prevent the formation of ammonia by putrefaction.

ANTIMONY

The only compounds of antimony which have toxicological importance are tartar emetic which is the potassium salt and the trichlorid of antimony. Metallic antimony is generally considered poisonous, as injurious symptoms have been caused by the inhalation of its vapor; but these symptoms are more likely due to the arsenic with which antimony is usually contaminated.

Tartar emetic is a white, crystalline substance, easily soluble in water. Besides the use of tartar emetic by itself, it is also used in the wine of antimony, and in the compound syrup of squill. It may give rise to both acute and chronic poisoning, and has sometimes been used criminally in the latter form.

Symptoms.—Acute Poisoning.—Its immediate action is that of an irritant, producing severe pain in the stomach, persistent vomiting, and diarrhea. Its emetic action has often defeated the purpose of criminal administration. In acute poisoning by tartar emetic the patient is generally attacked within half an hour after ingestion with continual vomiting, precordial cramps, burning sensation in the epigastrium, distention, watery and frequent stools, dryness of the throat, and difficulty in deglutition; a disagreeable metallic taste in the mouth, and often a copious discharge of saliva. The mucous membrane of the mouth is coated with a white crust like that of canker, which later becomes brown or black in color, and in fatal cases we see the same conditions in the stomach and intestines. In a little while the patient becomes faint and

may fall into a state of syncope. The region of the stomach is painful, vomiting persists, the vomitus is often mixed with blood, the urine becomes scanty, the extremities cold, covered with a clammy perspiration, and there is loss of muscular power. Later, in the course of a few days, there is often a pustular eruption like that caused by antimonial ointment. In severe cases which do not tend to recover speedily, hiccough persists, the stools become involuntary, the extremities cyanotic, convulsions ensue, and death may take place in from 3 to 6 days. In children death occurs often earlier, sometimes within a few hours. In an exceptional case, where the amount of tartar emetic ingested is considerable, vomiting may not ensue, but complete prostration, collapse and convulsions followed by death in a few hours.

A single large dose of tartar emetic does not often cause death. The vomiting induced by this agent prevents its absorption, and the patient after vomiting for some time begins to convalesce, and the surface of the body becomes warm. Usually this is followed for a short time by headache and epigastric discomfort. The patient is well again in from ten days to two weeks.

The trichlorid of antimony produces similar symptoms, but there is also great corrosion of the mucous membrane of the digestive tract on account of the strongly acid reaction of this agent.

Chronic poisoning has been produced by the administration of continued small doses of antimony, and people have attempted suicide or murder by this means. The symptoms resemble those of natural disease, such as weak pulse, albuminuria, prostration, and disturbance of the digestive organs. In the well-known case of Mrs. Pritchard, the principal symptoms after taking food were vomiting, accompanied by constant thirst, chronic diarrhea, and extreme depression. Her husband who administered this poison in small doses claimed that she was sick with typhoid fever. She lived for four and one-half months, and finally died.

Lethal Dose.—Three-fourths of a grain of tartar emetic is the smallest dose on record that has produced a fatal result in a child. Ten grains is a dangerous dose and may prove fatal. If this amount was given in small repeated doses it would be more dangerous. When vomiting is not at once produced after the ingestion of antimony the danger of a fatal termination is greater because more of the poison is absorbed, but in these cases it usually follows that there is a severe diarrhea which hastens the elimination of the drug and tends to prevent a fatal termination.

Treatment.—Where the ingestion of this poison produces free emesis, other emetics are not necessary; but where vomiting is not caused after ingestion of tartar emetic, some other emetic, such as sulphate of zinc or

mustard, should be given to assist in removing the antimony from the stomach. Strong tea and tannin will neutralize the antimony in the stomach, and this can later be washed out with the stomach-tube. To overcome the depression, alcoholic stimulants and applications of heat to the extremities should be employed. Morphin may be given in extreme cases to relieve pain and distress and also after the elimination of the poison to check the diarrhea.

Differential diagnosis between poisoning by antimony and arsenic is not easy. It may be said that the intoxication symptoms of poisoning by antimony are, as a rule, more severe than those of arsenic.

Postmortem Appearances.—These are not very different from those which appear from death by arsenic, *e.g.*, inflammatory changes in the mouth, swollen mucous membrane, fatty degeneration of the kidneys, liver, heart, and blood-vessels. The characteristic differences from arsenic poisoning are absence of blood in the stomach, signs of pneumonia, and absence of degeneration in the muscular tissue. Ordinarily, especially after a single large dose of tartar emetic, the esophagus appears red and presents some ulcerated spots; the stomach and intestines show severe inflammation accompanied by softening of the mucous membrane. The internal surfaces of the stomach and intestines are covered with a black, thick secretion, sometimes streaked with blood. Antimony produces fatty degeneration of the liver, which may extend to the other organs, especially the kidneys and heart. The liver may become so fatty that it resembles the condition known as acute yellow atrophy. In fact, antimony, arsenic, and phosphorus are among the chief causes of this disease.

Chemical Detection.—Antimony (given in a single large dose or in repeated small doses) is absorbed and eliminated chiefly by the kidneys. At the same time it is deposited to a greater or less extent in the tissues and organs. If this examination is made soon after death and the administration of the poison was in sufficient quantity, it may be found in the stomach or bowels, and little or none may be present in the liver. After a variable time it disappears from the stomach and bowels, while the liver and kidneys may contain it in large quantity. In certain conditions of the system complete elimination may be prolonged over a month or more, but in a healthy subject ordinary medical doses are eliminated quickly.

Tests.—On heating tartar emetic it blackens and there is evolved an odor similar to burnt sugar, this, of course, being due to the tartaric acid. A black residue with an alkaline reaction is left upon the platinum foil. If sulphuretted hydrogen or ammonium sulphid be added to tartar emetic there is produced an orange color, owing to the formation of antimony sulphid. A solution of tartar emetic acidified with hydro-

chloric acid is precipitated by sulphuretted hydrogen, producing an orange-colored precipitate which is easily soluble in ammonium sulphid or in a solution of potassium or sodium hydrate; insoluble in ammonium carbonate, and by this means can be easily separated from arsenious sulphid which is soluble in ammonium carbonate. If a solution of tartar emetic is acidified with hydrochloric acid and a piece of metallic zinc enclosing a bit of platinum foil introduced into the solution, galvanic action occurs; hydrogen gas is evolved, whereby the antimonial compound is decomposed and metallic antimony is deposited upon the platinum as a black, sooty coating, and can be readily distinguished by appropriate tests.

Reinsch's test is performed as with arsenic: the coating upon the copper is more sooty than with arsenic, and when the copper is heated in a tube the white precipitate is nearer to the source of heat than with arsenic, and occurs usually in prismatic crystals; rarely in the form of octahedra. If the copper containing a coating of antimony is heated in a solution of potassium hydrate the antimony will be dissolved and can be detected by the addition of hydrogen sulphid, filtering off the copper sulphid and acidifying with hydrochloric acid, when the antimony will appear as an orange-colored sulphid.

Marsh-Berzelius Test.—This is performed in the same way as with arsenic. The mirror, both in the tube and upon the porcelain plate, is usually blacker and less brilliant than that of arsenic.

The following table may serve to distinguish between arsenic and antimony mirrors.

Arsenic	Antimony
Volatile; easily displaced in a current of hydrogen.	Less volatile; melting into minute globules.
Disappears in the presence of nitric acid. The solution evaporated to dryness deposits, by a neutral solution of nitrate of silver, a brick-red precipitate of arseniate of silver.	Gives no reaction with nitrate of silver. Preserves its metallic luster, especially if the latter is considerable.
Is dissolved by the addition of an alkaline hypochlorite.	Does not dissolve in an alkaline hypochlorite.
The metallic ring heated in a current of hydrogen sulphid gives yellow sulphid of arsenic, soluble in ammonia; insoluble in hydrochloric acid; is not dissolved by ammonium sulphid.	The ring gives an orange-colored sulphid which is transformed into a volatile chlorid by hydrochloric acid gas. Is dissolved by ammonium sulphid.
The gas set free in Marsh's apparatus reduces the nitrate of silver and gives a soluble arsenious acid; metallic silver being precipitated.	The gas reduces nitrate of silver, and the antimony is wholly precipitated with the silver.

The best method for separating antimony and arsenic is based on the actionof arseniuretted hydrogen and of antimoniuretted hydrogen upon a solution of nitrate of silver. Instead of forming a metallic ring in Marsh's apparatus, the gas is passed into a test-tube containing a solution of silver; the arseniuretted hydrogen is transformed into arsenious acid; the antimoniuretted hydrogen gives the insoluble antimonid of silver;

the two gases produce at the same time reduced silver. When all the suspected matter has been introduced into the apparatus, and the gas has been disengaged long enough, the black precipitate of silver and the antimonid of silver are collected on a filter and washed. In the filtrate the excess of silver is precipitated by hydrochloric acid as silver chlorid; this is filtered off, and the arsenic is precipitated from the filtrate by hydrogen sulphid. The black residue which remains upon the filter is digested with aqua regia, diluted with a little water, the chlorid of silver filtered off, and in the filtrate chlorid of antimony is left. Instead of using aqua regia, the black residue can be boiled with a concentrated solution of tartaric acid which will dissolve the antimony, and not the silver.

In examination of the tissues, the liver should be the organ selected as the most likely to contain antimony.

The method for the destruction of organic material is the same as for arsenic. The hydrogen sulphid precipitates the antimony in the form of an orange-colored sulphid. This color, however, is often disguised by the presence of organic sulphur compounds, so that no inference, therefore, should be drawn from the color of the precipitate produced by the hydrogen sulphid. This precipitate which may contain antimony sulphid should be dissolved in a mixture of ammonia and ammonium sulphid, boiled, evaporated to dryness, oxidizing the residue with concentrated nitric acid, and evaporating to dryness again. The residue is then dissolved in water, with the addition of a little hydrochloric acid, and subjected to the tests above. The spleen, kidneys, and urine may be examined in a similar manner.

Of course, the presence of antimony in the stomach contents or in the liver or other organs may be due to the administration of proper medicinal doses of the salt. It may even be given in cases of poisoning with other substances on account of its emetic action, without any thought of the complications it may cause to the chemist in case of death. Of course, in such cases its importance, medico-legally, is often thwarted.

ARSENIC

Arsenic (and its compounds) is one of the most, if not the most important poison we meet with, as it is so commonly used and so easily obtained.

Occurrences.—Many common household articles, such as "fly poison," "moth exterminators," and numerous vermin killers, contain large quantities of arsenic. "Rough on Rats" is composed of white arsenic and powdered charcoal. Formerly many kinds of enameled cooking utensils contained arsenic, but at present they are generally

arsenic-free. It has often been used by veterinarians and stable men in the form of so-called arsenic balls to improve the coat or appearance of the horses. Soft coal burned in open fires may cause arsenical poisoning. Soot in cities where soft coal is used in large quantities may often cause arsenical poisoning. It has been found in nearly every article of clothing in common use, such as dress goods, linings, underwear, shoes, slippers, stockings, etc. Formerly it was often found in wall paper and furniture coverings, but lately its use in such articles has rather diminished. Pasteboard boxes, covered with glazed paper, playing cards, and many playthings covered with paper and paint often contain arsenic. A recent epidemic of arsenical poisoning in England was caused by arsenic in beer. In this case the arsenic was in the sulphuric acid which had been used in the manufacture of commercial glucose used in the beer. Wool-washers often use "sheep dip" or an arsenic soap to kill the parasites in the wool. Anilin dyes formerly contained arsenic in considerable quantities, and at present arsenic is often found in them, especially in the red dyes, and of course articles covered with them may give rise to arsenical poisoning.

Arsenic is used in many medicinal preparations: Liquor potassii arsenitis (Fowler's solution); liquor sodii arsenitis (Harles's solution); liquor sodii arsenatis (Pearson's solution); liquor arseni et hydrargyri iodidi (Donovan's solution). Any of these may cause arsenical poisoning. Almost all of the so-called "cancer paste cures" contain arsenic in large quantities, and many of the "tonic" pills also contain arsenic as their chief ingredient.

Commercially, we meet with arsenic in many pigments, such as Scheele's green (copper arsenite) which is used in paints, also in coloring glazed paper, such as are used in book covers, etc., for coloring artificial flowers, window draperies, etc. Paris green (Schweinfurt green) is a mixture of the acetate and arsenite of copper, and is very commonly used on potato plants and on tobacco. The use on the latter is dangerous, as the leaves are the part of the plant which is consumed. There has been considerable discussion as to the cause of arsenical poisoning when the source of arsenic was an arsenical pigment in wall-paper. It has been agreed that a volatile arsenic compound is produced by certain moulds, such as *muco-mucedo aspergillum glaucum* and others, in the presence of arsenic, moisture, and a temperature of 60–85° F. It is probably an organic combination of arsenic oxid. By the laws of the State of Massachusetts, wall-paper containing more than 1/10 of a grain of arsenic to the square yard is not allowed to be sold, and this amount is as high as is consistent with safety.

Metallic arsenic, is a steely-gray, crystalline substance, which is very brittle with a bright luster. It also exists as a black, amorphous powder.

It is stable in a dry atmosphere, but oxidizes slowly in the presence of moisture, and is easily converted into arsenic trioxid.

Arseniuretted hydrogen, hydrogen arsenide, arsin, AsH_3, is formed by the action of nascent hydrogen upon arsenic compounds capable of reduction. It is a colorless combustible gas, with a garlicky odor, burning with a bluish flame, which when pressed against a cool surface deposits arsenic as a brownish-black powder. It reduces nitrate of silver solution and is the most poisonous of the inorganic compounds of arsenic. *Arsenious oxid*, As_2O_3, improperly called arsenious acid, is a white, crystalline body, soluble in water, forming arsenious acid with a slightly acid reaction, and a sweetish, metallic taste. It sublimes at 218° C. Nascent hydrogen converts it into arsenic, and oxidizing agents convert it into arsenic oxid. With metallic bases it forms salts called arsenites, while with acid radicles it acts as a base.

Arsenic oxid, As_2O_5, is a white, amorphous deliquescent body, soluble in water with which it forms arsenic acid.

Arsenious sulphid (arsenic trisulphid, As_2S_3, King's Yellow, orpiment) is a yellow, crystalline body, soluble in alkaline hydrates or ammonium sulphid, but insoluble in dilute acids.

By far the greater number of recorded cases of poisoning by arsenic are those of suicides; very much less are the number of cases caused by accident, and there are only a few cases of attempted murder.

Symptoms.—Acute Poisoning.—In acute poisoning by arsenic the symptoms begin soon after ingestion, with a burning sensation in the throat and stomach, followed by nausea and vomiting, great thirst, intense pain in the pit of the stomach, soon followed by diarrhea and painful discharges which are usually water, sometimes resembling the rice-water discharges of cholera, and other times bloody, like the discharges of dysentery. There is usually intense headache, the limbs are cold, prostration is great, the urine is much diminished or even suppressed, the face shows some anxiety, the lips and often the skin become blue and livid, and death takes place within twenty-four hours. It is this form of poisoning which may under certain circumstances be mistaken for Asiatic cholera. The common point of difference between the symptoms of the two diseases is the burning pain in the throat and stomach, and that in this form of poisoning the vomiting generally precedes the purging.

Chemical analysis of the urine passed during life, or of the organs after death is absolutely necessary to confirm the diagnosis. Rarely do the symptoms of poisoning by arsenic assume the narcotic form, in which case the pain, vomiting, and purging may be partially or wholly absent.

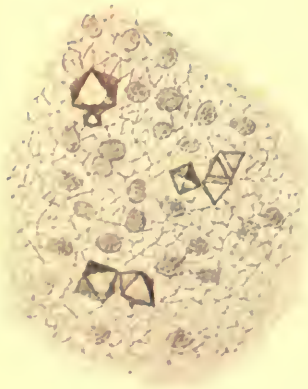
The shortest fatal period of acute poisoning by arsenic is that recorded

by Taylor in the case of a young man who died within twenty minutes after the first appearance of the symptoms. There apparently is no relation between the amount of arsenic ingested and the rapidity of the symptoms and fatal period. These depend rather upon the local conditions, such as whether the stomach is full or empty, the solubility of the arsenical preparation, etc. Fatal termination may take place within two hours or it may be prolonged for a few days.

Subacute Poisoning.—In a large number of cases of arsenical poisoning the progress of the case is very much less rapid, life may be prolonged for several days. Vomiting, which occurs at the beginning of the attack abundantly and frequently, continues for one or two days, when it ceases temporarily and there may be no stomach symptoms, although the weakness, thirst, and prostration remain. Later, however, according to circumstances, the vomiting recurs often with increased violence, and even when no fresh dose of the poison has been administered. The abdomen becomes swollen and tender to the touch and the original symptoms are repeated; occasionally an eruption appears upon the face; rarely does the patient have jaundice. Salivation is a very common condition in this form of poisoning.

Chronic Poisoning.—The phenomena accompanying chronic poisoning differs from the preceding in many instances, and the following will describe a typical case: "A woman put daily into the soup of her fellow-servant a small quantity of arsenious acid in powder. Shortly after dinner this person was seized with vomiting which led to the rejection of food and poison before the latter had caused any serious mischief. As this practice was continued for about six weeks the stomach grew exceedingly irritable; there was pain in the bowels, and the woman became much emaciated. There was also spitting of blood, with such a degree of nervous irritability that a current of air caused an attack of spasms and convulsions. When the patient found that she could not bear anything on her stomach, she left the place and passed two months in the country. Her health became gradually restored and she returned to resume her usual occupation. The prisoner, however, renewed her attempts; and to make sure of destroying her victim, gave her one morning in coffee two doses of arsenious acid in powder. Violent vomiting ensued and the poison was expelled with the breakfast. Arsenic was detected in the vomited matter, and an explanation of the cause of the long previous illness became clear. Under proper treatment the patient recovered."

This chronic or so-called "slow poisoning" by arsenic is a favorable method used by persons with criminal intent. The first symptoms in such cases will be shown by the smarting of the eye-lids and eye-balls, conjunctivitis, irritation of the membrane lining the throat and nose



POISONING BY ARSENIC.

Death after about twenty hours. A portion of the mucous membrane of the stomach, showing crystals of arsenic (x 340 diam.).

and the peculiar burning of the tongue and mouth. The tongue has a red, velvety-coated appearance, the face is sallow and sometimes jaundiced and the skin often has an eruption. There also may be noticed neuralgic pain, tingling of the toes, and the muscles are sore on pressure. In the celebrated Maybrick case in which Mrs. Maybrick was tried and convicted in 1889 in Liverpool, an example is furnished of the slow poisoning from repeated doses of arsenic administered at intervals during fourteen days.

Among other symptoms observed in chronic poisoning there are catarrhal inflammation of the stomach and intestines, nose, larynx, and bronchi, degeneration of the mental faculties, paralysis of the lower extremities, inflammation of the liver and muscular atrophy.

Lethal Dose.—According to some authors, 2 grains of white arsenic is the smallest fatal dose, but Witthaus and Becker fail to find "any record of the clearly-established death of an adult from a dose of less than 30 grains of arsenic in the solid form."

In cases of criminal poisoning or of suicide, the dose of arsenic that is ingested generally exceeds the quantity necessary to produce death, so that the question of a minimum lethal dose is not very important.

In medicinal doses arsenious oxid may produce serious symptoms. The medicinal dose is from $\frac{1}{16}$ to $\frac{1}{12}$ of a grain, and physicians should be on their guard for the appearance of conjunctivitis, swelling of the eye-lids, and general depression as indication that the dose is too great or too frequently repeated.

Treatment.—Thorough washing out of the stomach and the giving of ferric hydrate in suspension freshly prepared or the ferric sulphate with magnesia and water should be employed.

Action.—In distinction from mineral acids, arsenic does not corrode living and dead tissue alike. Upon dead tissue there is scarcely any action, while upon living tissue the irritation is so great that inflammation appears at once and rapidly destroys the function of life in this tissue. The skin appears like a burn and the mucous substance becomes inflamed. According to Binz and Schultz, those organic structures of the body which assimilate oxygen, including the glandular structures, are the especial seats of the destructive action of arsenic. The neutral salts are as poisonous as arsenious acid. These authors believe that both arsenic and phosphorus act upon the cells discharging their atoms of oxygen, are converted into chlorids, and in this latter form exert that corrosive action which destroys the cells and blood. Binz maintains that the cell protoplasm yields its oxygen to arsenious acid, converting it into arsenic acid, and then the arsenic acid is again reduced.

Diagnosis.—The differential diagnosis between antimony and

arsenic has been previously discussed under Antimony. The symptoms of poisoning by these two elements are very similar, namely, inflammation of the mucous membrane of the mouth, vomiting and purging, dizziness and prostration, weakness of the pulse, muscular tremor, pustular eruptions, and cholera-like diarrhea. The differential symptoms are that in antimonial poisoning we have headache, cyanosis, and general paralysis, whereas in arsenic we have pain in the limbs and less persistent vomiting.

In the chronic forms the differential diagnosis between arsenical and antimonial poisoning is more marked; neuralgic pains are more common in arsenical poisoning, and in antimonial poisoning we have conjunctivitis and the dulling of the mental faculties. For a more definite diagnosis the chemist should be consulted to definitely determine whether we are dealing with a case of arsenical or antimonial poisoning.

Postmortem Appearances.—The chief changes are caused in the stomach and intestines. The stomach is more or less uniformly brownish-red, often ecchymosed in patches, and in places there are spots or streaks of blood. These often have the appearance of crusts and are not infrequently mistaken for gangrene, and the slight depression beneath them for ulceration. But, as a rule, ulceration and gangrene are not a result of arsenical poisoning, and if present they are probably due to other causes. Perforation rarely occurs. The arsenic, if it has been taken in powder form, is often found imbedded in the folds of the mucous membrane and closely adherent to it, appearing as many white points. The irritation seen in the stomach is also found in the kidneys, as the poison passes through them, and we occasionally have bloody urine. The organs in these cases are found to be congested as the results of the irritation.

The period of time necessary that these inflammatory conditions of the stomach should be developed varies considerably, and not very much inference can be drawn from the appearance of the stomach walls. Occasionally, even arsenic has been discovered adherent to the walls of the stomach without any signs of inflammation, so that ulceration and inflammation of the stomach walls can only be considered as corroborative evidence and most reliance must be placed upon the chemical detection of the arsenic.

The question as to whether arsenic is a preservative agent for dead-tissue has been much discussed. There is no doubt that arsenic or an arsenical solution exerts more or less of a preservative effect upon organic tissue, and experiments upon animals poisoned by arsenic tend to show that putrefaction is delayed longer than usual. A remarkable case was that of a woman supposed to have been poisoned by arsenic,

POISONING BY PARIS GREEN.

Death after twenty hours. Blanching of the peritoneal surface of the stomach, with hemorrhage, beginning slough and deposit of poison.

whose body was disinterred fourteen years later and found in a state of good preservation. Arsenic was found in the body and her husband was convicted. On the other hand, certain cases have been noted where decomposition of the body in cases of arsenical poisoning has been rapid, and there is no doubt but that various causes, such as the dryness of the soil and the depth at which the body has been buried, have most important action upon the putrefaction of the body. Hence the medical witness is not authorized to assert that because the body has resisted to a certain extent the process of putrefaction that this preservation is due to arsenic, as it may be really attributable to other causes.

In chronic cases where death has resulted from the ingestion of arsenic in small repeated doses, the arsenic becomes scattered throughout the system and this exercises a more complete antiseptic action on the dead body.

Embalming Fluids.—Formerly, embalming fluids used to contain arsenic as well as other poisonous substances, and this brings up the question as to the value of the detection of arsenic in cases where it has been detected after the body has been embalmed. In one celebrated case, that of Sarah Jane Robinson, one of the expert chemists, Dr. W. B. Hills, could not be made to say in his testimony that in an embalmed body the presence of arsenic was indicative of having been administered before death. On the other hand, Dr. E. S. Wood testified that on account of its unequal distribution throughout the various tissues of the body it might be inferred that arsenic recovered from an embalmed body was injected postmortem, and that if the amount of arsenic found in the body was uniformly distributed through its organs the inference might be drawn that the poison was received and absorbed before death. In other words, the effect of embalming would be distribution by a slow and unequal diffusion after death when injected into a dead body; while, if administered during life, it would pass into the tissues of the body by the living processes of absorption. It has sometimes been contended in trials that a buried body may absorb arsenic from the surrounding soil in a cemetery; if arsenic is found in such soil it is also in an insoluble form, generally as arsenical iron pyrites. In his testimony in the above Robinson trial, Dr. Hills gave as his opinion that bodies lying in arsenical soil do not absorb arsenic in their dead tissues. Where bodies are exhumed for chemical examination for arsenic, it is desirable to collect samples of the soil surrounding the corpse for the purpose of analysis.

Chronic Poisoning by Absorption in Places Where Arsenic is Used.—Chronic poisoning may be caused by absorption of small amounts of arsenic continued over a long period of time. This is occasionally

caused by using some preparation of arsenic medicinally, but more frequently by its use as a pigment in ornamenting household articles.

The persons most liable to this form of poisoning are those workmen engaged in manufactories where pigments containing arsenic are used. A very interesting case is reported by Hoffman and Ludwig:[1] A woman 63 years of age and a daughter 22 years old were engaged in making crosses from artificial moss and flowers, a very large number being made during the few weeks before "All Souls Day." The first year both were poisoned, but the poisoning was only temporary. The next year, however, the symptoms were very severe, the daughter recovered after several months, but the mother died. The source of poisoning was traced to the arsenical fuchsin used for coloring the artificial flowers. Of six different samples of fuchsin only one was found free from arsenic.

Workmen continually employed with arsenical pigments are particularly prone to this form of poisoning, and they usually suffer with more or less severe irritation of the skin and mucous membrane with which the pigment comes in contact, coryza and conjunctivitis. If proper precautions are not taken against the inhalation of the dust, there may be sore throat and some irritation of the stomach, and this may be followed by more or less dyspepsia, loss of appetite, nausea, vomiting, and later by nervous symptoms.

Persons occupying rooms, the walls of which are covered with arsenical paper, are liable to symptoms very similar to those described in the case of workmen; especially in the case of women and children are symptoms more apt to occur than in men on account of the greater susceptibility of women and children to its influence. Formerly, green paper was considered to be the chief source of arsenical poisoning, and probably on account of this popular idea the number of arsenical green papers on the market is constantly diminishing; but on the other hand, we find large numbers of red, brown, and blue papers containing arsenic in considerable quantities. No inference as to whether the paper is arsenical or not can be drawn from its color. A careful examination by the chemist is the only sure means.

Chemical Examination.—White arsenic, when thrown upon water remains mostly upon the surface, although heavier than the water. This serves as a preliminary test to distinguish arsenic from other heavy white, crystalline powders, such as corrosive sublimate, calomel, lead and bismuth salts. It is volatilized by heat at about 218° C. This will enable the physician even at the bedside to distinguish between arsenic and other mineral poisons except corrosive sublimate and calomel. In the laboratory it is better to perform this test by heating a little of the

[1] *Wien. med. Jahrb.*, 1877, p. 501.

powder in a glass tube closed at one end, when the sublimate will be condensed upon the cool portion of the tube in the form of white, crystalline octahedra of arsenic.

Heated in a narrow tube or in a Berzelius reduction tube with charcoal, metallic arsenic is condensed by sublimation upon the cool portion of the tube in the form of a ring or crust, technically known as a "mirror", of an iron-gray color, brilliant and lustrous upon the outer surface, and crystalline upon the inner. The brown ring which is often produced further out on the tube is a mixture of arsenic and arsenious oxid. The sublimate obtained by the reduction of the compounds of mercury, as calomel and corrosive sublimate, have also a metallic appearance, but are easily distinguished from that of arsenic in that the minute globules of metallic mercury can easily be seen.

White arsenic or metallic arsenic as obtained by the reduction tube may be mixed with concentrated nitric acid, the mixture evaporated to dryness, and the appropriate tests to the resulting arsenic acid applied. Among the tests for arsenic in solution, the most important are the following: Arsenic is thrown down from acidified solutions (previously reduced, if necessary) by hydrogen sulphid as arsenious sulphid, which is yellow. This precipitate is soluble in ammonium sulphid or ammonium, sodium and potassium hydrate, by means of which it can be separated from the sulphids of lead, copper, mercury, bismuth, and cadmium. The arsenic sulphid can be converted into arsenic acid by hot nitric acid or hydrochloric acid and potassium chlorate, and the test for arsenic acid applied.

Ammoniacal silver nitrate throws down arsenic from its solution as silver arsenite, but phosphoric acid is thrown down in a similar way and should not be confused with arsenic.

Cuprammonium sulphate gives a reaction similar to the ammoniacal silver nitrate. Great care should be taken not to use too much of the reagent, lest the color of the precipitate be obscured. The precipitate is the familiar Paris green which is readily soluble in ammonia and free acids.

The objections to the above tests may be briefly mentioned. Phosphoric acid gives a yellow precipitate with ammonio-nitrate of silver exactly like arsenic acid; many organic acids cause a green precipitate with the copper reagent; soluble salts of cadmium give with hydrogen sulphid a yellow precipitate similar to arsenic sulphid.

Marsh-Berzelius Test.—This process for obtaining arsenic from mixtures is extremely delicate; the process consists essentially in the generation of hydrogen gas by the action of sulphuric acid on zinc, which in the presence of arsenious acid, and the consequent evolution of arseniuretted hydrogen deposits metallic arsenic upon a porcelain plate

held in the flame, or within the glass tube through which the gas is passing if a flame is applied to the proximal portion of the tube.

The smallest form of Marsh's apparatus, which is by far the best, consists of a wide-mouthed bottle of about 4-oz. capacity with a closely fitting cork perforated for two tubes, one of which, a funnel tube, passes beneath the liquid; the other bent at right angles enters the bottle just below the cork. This tube is connected with a tube filled with bits of fused calcium chlorid, and the gas after being thus dried is passed through a hard glass tube which is drawn out to a fine point. In this apparatus hydrogen is generated by pure zinc and by dilute sulphuric acid. This action is continued until the atmospheric air is completely expelled before lighting the escaping hydrogen in order to avoid the risk of an explosion.

To test the apparatus in order that one may be sure that the materials are free from arsenic, the gas should be generated for half an hour; then we may be sure that the zinc and acid are free from arsenic. Then a portion of the suspected liquid may be poured into the funnel tube, when, if arsenious acid is present, there will be deposited at the distance of half an inch or so from the part to which the flame is applied, a metallic ring or mirror. The liquid introduced through the funnel tube should contain no nitric acid nor any substance from which nascent oxygen might be generated.

This mirror should be tested for arsenic as follows: One of the arsenic mirrors should be heated gently in a current of air, when the arsenic will be volatilized, and appear in the cool portion of the tube above as a white, crystalline sublimate of arsenious oxid. Another mirror should be attached to the hydrogen sulphid apparatus and gently heated. While a very slow current of hydrogen sulphid is passed through the tube, the dark ring will disappear and the yellow sublimate of arsenious sulphid appear, which is insoluble in hydrochloric acid, soluble in ammonium sulphid.

Reinsch's Test.—If a bit of copper foil, bright and clean, be introduced into an acidified arsenical solution and heated to boiling, the arsenic will be deposited as an iron-gray film upon the copper; the copper on being removed is washed in distilled water, dried and introduced into a reduction tube. On warming, arsenious oxid will be sublimed and deposited on the sides of the tube; occasionally where we are dealing with a large amount of arsenic we may get metallic arsenic on the lower portion of the tube, and on the upper portion arsenious oxid crystals, the latter can easily be recognized by a lens and should be dissolved in water and confirmed by appropriate tests.

Isolation of Arsenic from Organic Mixtures.—In order to test organic mixtures for metallic poisons it is essential that the solution

should be as free as possible from organic matter. If the solution is to be tested by the Reinsch method, the solid material should be cut into small fragments and, if necessary, distilled water added, and also hydrochloric acid in slight excess. This mixture should then be boiled for an hour until the solids are dissolved or broken down into fine flakes. Filter through muslin or cheese-cloth, heat the filtered liquid again to boiling-point, and introduce the copper as described above.

If, however, we wish to test for arsenic by Marsh-Berzelius method, we treat the organic matter with a mixture of sulphuric acid and nitric acid, evaporate nearly to dryness until the whole is completely oxidized. The heat is continued until sulphurous fumes are given off. After cooling, the sulphuric acid solution is diluted, boiled to remove all traces of nitric acid, cooled and then can be introduced into a Marsh's apparatus.

The general method for the isolation not only of arsenic, but for other metallic poisons and the destruction of organic matter is to divide the solid matter finely, preferably in a clean meat cutter, adding a large excess of hydrochloric acid and a few crystals of potassium chlorate, and heating the whole in a large porcelain dish over a water-bath. The liquid will become light yellow, and water should be added from time to time as it evaporates. If necessary, fresh crystals of potassium chlorate should be added whenever the fluid becomes dark brown instead of remaining yellow. This should be continued until the fluid remains yellow after being heated at least half an hour after the last addition of potassium chlorate. In this way arsenic, if present, is converted into arsenic oxid. The mixture is then allowed to cool so that fatty matters are separated, filtered, and the solid portion remaining upon the paper thoroughly washed. The filtrate and wash waters are united and warmed over a water-bath until all of the free chlorin is expelled. The arsenic oxid must then be converted into arsenious oxid by the addition of a little sulphurous acid or acid sulphite of sodium, and heat continued until the odor of sulphurous acid has disappeared. The liquid is filtered, if necessary, into a beaker, and a slow stream of hydrogen sulphid passed through it for 24 hours. This will precipitate arsenic in the form of arsenious sulphid; it also precipitates some organic substances as sulphur compounds which may disguise the color of the arsenious sulphid. The precipitate should be separated by filtration and washed; a heated mixture of ammonia and ammonium sulphid is then poured upon the precipitate on the filter-paper, which will dissolve the arsenic together with the organic sulphids; any sulphid of antimony or of tin that may be present will also be dissolved. The filtrate is collected in a small dish and evaporated to dryness. Any organic sulphid that may be present is destroyed by moistening with concen-

trated nitric acid, and evaporating to dryness, repeating this process three or four times if necessary until all of the arsenic is converted into arsenic oxid. The arsenic can then be dissolved in hot water, and a portion of the solution subjected to the other tests for arsenic acid. Another portion can be reduced to arsenious oxid by acidifying with acid and boiling with acid sulphite of sodium.

Arsenic Oxid (As_2O_5)

Arsenic oxid is seldom met with. It is poisonous to animals, but its chief importance lies in the fact that in the separation of arsenic from organic tissues it is this form of arsenic which we obtain.

The principal tests are the ammonio-nitrate of silver which gives a reddish-brown precipitate soluble in both an excess of ammonia and acids; and the cuprammonium sulphate test which gives a bluish-green precipitate instead of a light-green color.

Sulphids of Arsenic

There are several of these compounds known in commerce: realgar, which has an orange-red color; orpiment, which is yellow, and another preparation which is a compound of pure sulphur and arsenious sulphid. The pigment known as King's Yellow contains arsenious sulphid, and a considerable amount of lime and other sulphids. Cases of intentional and accidental poisoning with orpiment are known.

The sulphids of arsenic when pure are not poisonous, but when exposed to a moist atmosphere they are partially oxidized, and thereby changed into arsenious oxid, so that cases reported as poisoning by arsenic sulphid are really cases of arsenious oxid poisoning. The sulphids when pure are insoluble in water, or hydrochloric acid, but are soluble in hot strong nitric acid, being thus converted into arsenic oxid. They yield metallic arsenic on reduction.

Potassium Arsenite

This substance is used in medicine under the name of Fowler's solution, or liquor potassii arsenitis. It has occasionally been the source of fatal poisoning, and the symptoms are similar to those produced by arsenious oxid. The dose, however, that will produce poisonous effects is very uncertain.

Copper Arsenite

This substance is poisonous more on account of the arsenic than on account of the copper which it contains. Years ago it was used as a coloring ingredient in confectionery. Of recent years there have been a number of acute arsenical poisoning by Paris green, a substance which

can be bought at every country store for the purpose of killing potato bugs. The symptoms caused by a large dose are exactly the same as those caused by arsenious acid.

Arsenite of copper is easily recognized, since it responds to both the test for arsenic and copper. Its bright-green color will usually make one suspicious of its nature. A bit of the powder treated with a drop of ammonia immediately imparts to the latter a deep blue color. In legal cases the presence of arsenite of copper, or Paris green, must be confirmed by applying all of the tests for both arsenic and copper. Its isolation from organic mixtures is the same as that described above.

BARIUM

The compounds of barium which have proved fatal are the chlorid, carbonate, acetate, nitrate, and sulphid. The salts of barium are not common poisons, and most of the cases of poisoning by them have been accidental.

Symptoms.—Kobert divides the symptoms into these groups: *Local*, consisting in general malaise, nausea, salivation, vomiting, and pain in the stomach. This group merges easily into the *second*, which is excitation of the alimentary canal, both of the nervous and muscular structures. *Third*, excitation of the brain and motor centers, which leads to convulsions and may result in paralysis. *Fourth*, muscular contraction; the heart and blood-vessels show precordial distress, slowing of the pulse and strong cardiac pulsation, increased blood-pressure and rigid arteries; conjunctivitis and catarrh.

Lethal Dose.—A dose of 100 grains of barium chlorid has proved fatal in 15 hours; 4 drams of barium nitrate proved fatal to a man in 6½ hours, and 60 grains of barium carbonate was followed by fatal results.

Treatment.—The desired result is to render the barium insoluble, as in the form of sulphate, so that the administration of magnesium sulphate or sodium sulphate is indicated.

Chemical Detection.—Barium salts when introduced into the colorless flame of a Bunsen burner impart a greenish color to it, which, when examined with the spectroscope, gives characteristic bands. Barium salts are precipitated from neutral or alkaline solutions by ammonium carbonate in the form of a white granular precipitate, carbonate of barium, which is readily soluble in dilute acid with effervescence. Barium salts are precipitated by sulphuric acid or soluble sulphates producing barium sulphate which is insoluble in dilute nitric or hydrochloric acid.

We must bear in mind in the separation of barium from organic mixtures that the sulphates normally present in the animal tissues or in the food may cause a precipitation of the barium in the form of sulphate, thus rendering it insoluble, and so cannot be detected in the filtrate, but

must be sought for in the undissolved mass remaining upon the filter after treatment with potassium chlorate and hydrochloric acid. This residue should be fused with sodium and potassium carbonates, the fused mass extracted with water, filtered, and washed. The residue will consist of barium carbonate which can be dissolved in dilute acids and tested by the above tests.

BISMUTH

Bismuth has very rarely been the cause of death by poisoning. In medicine it is most commonly used either as a citrate, subcarbonate or subnitrate. The last is the most common, and is the only one that need be mentioned, as the different properties of all three are the same, as well as their action. Bismuth subnitrate is a white, amorphous, tasteless, odorless powder, insoluble in water and alcohol, soluble in hot concentrated nitric acid, and precipitated from its solution on dilution with water. Formerly, bismuth was contaminated to a large extent with arsenic, and several cases reported as due to bismuth poisoning are undoubtedly due to the arsenic contained as an impurity.

Recently, cases of poisoning have been reported where symptoms have followed the application of ointments and surgical dressings containing bismuth subnitrate, and where there was no question of the presence of arsenic. Death is usually preceded by convulsions in this form of poisoning.

Symptoms.—From the internal administration of bismuth as well as from its absorption from surgical dressings are the well-recognized blue stains on the edges of the gums, stomatitis, looseness of the teeth, ulceration of the mucous membrane of the mouth, catarrhal inflammation of the intestinal tract, and the inflammatory condition of the kidneys due to the excretion of a metallic substance not normally present in the body. Where larger doses have been ingested, there generally occur a metallic taste in the mouth, pain in the throat, vomiting, spasms of the limbs and purging.

The peculiar discoloration of the gums similar to that produced by lead poisoning, the ulceration found in the mouth, and the presence of albuminuria will assist in the diagnosis of poisoning by this agent.

Chemical Examination.—Bismuth is readily separated from organic mixtures by the same processes as mentioned under arsenic. The sulphid of bismuth can be separated from the other sulphur compounds in the same way as lead sulphid, dissolved in nitric acid, evaporated to dryness, taken up with water, and this solution of bismuth nitrate employed for the test. Sulphuretted hydrogen precipitates bismuth in the form of a black sulphid which is insoluble in hydrochloric acid, but soluble in nitric acid. Ammonium hydrate precipitates bismuth

hydrate which is white. A solution of nitrate or chlorid of bismuth when treated with a large excess of water becomes turbid on account of the precipitation of the subnitrate or subchlorid. These basic precipitates are insoluble in tartaric acid.

BROMIN

Bromin, as such, is never used in medicine. It is met with in photographic studios and in chemical laboratories. It is a dark reddish-brown liquid, volatile at ordinary temperatures; its vapor is reddish-brown and is so heavy that it can be poured from one vessel to another. It is somewhat soluble in water, quite soluble in alcohol, ether, chloroform and carbon disulphid. One case is reported where a mixture of chlorin water and potassium bromid was given with fatal results. Of course, in this case the chlorin set free the bromin, and the person actually died from bromin poisoning.

In cases of prolonged poisoning by slow absorption or inhalation, the symptoms are yellow discoloration of the skin, the formation of blisters, bronchitis, conjunctivitis, headache and dizziness.

The diagnosis can generally be made from the characteristic odor of free bromin, yellow discoloration and, postmortem, the yellow vapor which is freely given off by the tissues of the body. The bromids of sodium, potassium, ammonium, etc., are used to a large extent in medicine. The action of potassium bromid is perhaps more intense than that of the others. In the long-continued use of potassium bromid there is diminished reflex sensibility, slow and feeble pulse, loss of voice, peculiar odor (fetid) of the breath, hoarseness, cough, and muscular weakness, especially of the lower limbs. In chronic poisoning, symptoms of general paralysis are not uncommonly reported. There is also occasional acne and ulceration of the skin.

Detection.—Free bromin can be recognized by its color, odor, appearance, the brownish color of its solution in chloroform or carbon disulphid, and by the addition of phenol, forming tribromphenol (melting-point, 95° C.).

CHLORIN

The principal source of poisoning by chlorin is its use in bleaching and laundering establishments. There are several cases of accidental poisoning reported and one fatal case. Chlorin is a yellowish-green gas, 2½ times as heavy as air, with a very irritating pungent odor, very soluble in water.

Symptoms.—The inhalation of chlorin causes difficult breathing, distress, and coryza. If it is inhaled in an atmosphere containing a large quantity of the gas, as may occur in the manufacture of disinfectants

and bleaching powders, accidents are very apt to occur. Continued exposure to the inhalation of this gas produces bronchitis and bronchopneumonia, and later coma and death. Often there is a purulent discharge, and sometimes a destruction of the mucous membrane of the respiratory passages. One and one-half parts to 1000 parts of air will produce dyspnea and coma in animals.

Exposure to pure air, the usual treatment of bronchitis, and appropriate treatment to stimulate the action of the heart is the best course of treatment to be adopted.

Detection.—Chlorin can generally be recognized by its color. It bleaches moist litmus paper. Passed into a solution of silver nitrate it causes a white precipitate of silver chlorid which is soluble in ammonia, insoluble in nitric acid.

CHROMIUM AND ITS COMPOUNDS

The chief sources of chromium poisoning are from its salts as the chromate and bichromate of potassium and the chromate of lead. Potassium chromate occurs as large yellow rhombic crystals which are soluble in water. It is used in the manufacture of lead chromate which is widely used under the name of "chrome yellow" as a pigment in dyeing. Potassium bichromate is an orange-red, crystalline body, soluble in water, with a bitter, metallic taste, insoluble in alcohol. It is used quite extensively in electrical batteries, dyeing, and in staining furniture, and it has given rise to several cases of accidental poisoning from such use. Locally, it acts as an irritant, causing ulceration upon the hands and skin. Internally, its action is also that of an irritant, causing symptoms similar to those of other irritant poisons.

Lead chromate, known as "chrome yellow", is largely used as a pigment in dyeing, and has been used as an artificial coloring agent in various articles of diet. It is insoluble in water and dilute acids, soluble in strong alkalies. The frequency with which this salt is used as a pigment for coloring articles in common use, such as children's playthings and confectionery, makes it important in the consideration of this substance. In one case of poisoning the symptoms did not commence until several hours after the ingestion of the "chrome yellow". Two children were taken sick at the same time with vomiting which lasted for several hours; the vomitus was yellow; there was great prostration, but no diarrhea and no pain. On the second day both had flushed countenances and were stupid. The younger, about 24 hours after the commencement of the symptoms, had a slight diarrhea which continued until death, which took place within 48 hours. On the third day an eruption appeared on the chest and abdomen of the older child. He was dull and stupid. On the fourth day the pulse and respiration became irregular,

the breath fetid, stupor and unconsciousness ensued, and the patient died five days after the ingestion of the poison. After death the mucous membrane of the stomach and duodenum was found swollen and loose, so that it could be easily raised from the submucosa. In some places the mucous membrane was entirely destroyed and perforation had taken place at one spot. There was also found hyperemia of the brain and its membranes, slight fatty degeneration of the liver, icterus, hyperemia of the kidneys, and a softened spleen.

Symptoms of Chronic Poisoning.—In addition to the symptoms noted above, there is bronchitis, conjunctivitis, and inflammation of the kidneys.

Lethal Dose.—Fifteen grains of bichromate of potash may be considered a fatal dose. The administration of bicarbonate of soda and the washing out of the stomach is advised.

Detection.—The presence of chromic acid is easily detected. Chromates are either red or yellow, and when soluble in water give red or yellow solutions. Hydrogen sulphid changes the color of such solutions to a dark green. Barium chlorid gives a yellow precipitate which is insoluble in acetic acid, but soluble in dilute hydrochloric acid. Sugar of lead produces a yellow precipitate of lead chromate, which is insoluble in nitric acid, soluble in potassium hydrate. Silver nitrate gives an orange-red precipitate of silver chromate which is soluble in nitric acid and ammonia, and is not produced in the presence of chlorids until the chlorin has first been completely precipitated as silver chlorid.

In the separation of chromic acid from organic mixtures we use the same process as for lead and arsenic. The chromium is converted into chromium hydrate, and remains in solution and is not precipitated by the sulphid of hydrogen, but on making the solution alkaline the chromium is precipitated in the form of chromium hydrate; this can be collected upon filter-paper, and after fusion with sodium carbonate the proper test for chromic acid performed.

COPPER

Copper is widely distributed in the mineral kingdom, in various ores, minerals, and salts. It is present in minute amount in many cereals and drugs; it also occurs in the ash after cremation of the human body. The metal itself cannot be considered as a poison, but many of its compounds act as irritants when taken into the system in large amount. The most common copper salts met with in cases of poisoning are the sulphate (blue vitriol), the subcarbonate or subacetate (verdigris), arsenite of copper (Scheele's green), and a mixture of this with copper acetate (Paris green), the two latter have been mentioned in connection with arsenic poisoning. Verdigris has been used in cooking to give to vegetables a more brilliant green color.

Copper sulphate occurs as large deep blue crystals, soluble in water, with an acid reaction and metallic taste, insoluble in alcohol. Copper subacetate is a mixture of copper acetate and copper oxid.

Acute poisoning by copper salts is not common. Bakers sometimes add copper sulphate to dough to whiten bread and to increase its weight, especially where poor flour is used, since the copper sulphate apparently improves the quality of the bread and helps the flour to absorb more water.

Copper salts, even in moderate doses, produce, after their ingestion, disturbances of digestion, such as pain in the pit of the stomach, nausea, vomiting, and colicky pains which are followed by diarrhea. The use of copper utensils in the preparation of food has occasionally given rise to serious consequences on account of the contamination of the food by some salt of this metal. If vessels are bright and clean, very little harm can result from this cause when ordinary articles of food are cooked in them and are not allowed to stand in them after they become cool. Salt, acids, and oily matters, however, act upon copper vessels, and if these are not clean the food may be contaminated in sufficient quantity to produce alarming symptoms, especially where the food has been allowed to remain in the vessels to cool. The use of verdigris or copper salts for the coloring of confectionery and other articles of diet is, of course, a reprehensible practice.

Cases are related in which copper coins have been swallowed, without causing any symptoms of copper poisoning, although a few rare cases of this sort have produced severe symptoms. The question of the amount of copper in the human body is of interest from a medico-legal point of view. Undoubtedly, there may be small traces of copper found in the human system normally, but these can hardly interfere with the detection of copper, where the same has been administered criminally.

The effects produced by copper in workmen exposed to its manufacture are symptoms of nausea, vomiting, gastric disturbances, diarrhea, oppression, and fever, as well as intestinal distress and continued constipation. A purple line may appear at the junction of the teeth and gums, similar to that produced by lead poisoning; this line is due to the formation of copper sulphid.

Symptoms.—In acute poisoning the symptoms are violent headache, vomiting and purging, severe colicky pains, salivation, cramps in the limbs, and convulsions; sometimes jaundice is observed. Chronic poisoning by copper is accompanied by the above symptoms to a certain extent, and most of the symptoms recorded by various writers are probably due to chronic poisoning by other metals, as arsenic, with which copper is very apt to be contaminated.

Postmortem Appearances.—The mucous membrane of the stomach and intestines is inflamed, and occasionally the small intestine is perforated; there is generally great distention of the alimentary canal, but the most important appearance is the greater number of inflammatory lesions as compared with blood extravasation.

Lethal Dose.—The lethal dose of copper is hard to determine. Three ounces of copper acetate and a little more of the sulphate, may be considered as fatal.

Chemical Examination.—The tests for copper are quite delicate, and there is usually no difficulty in detecting it, even when present in small quantities. The copper salts are either green or blue, and metallic copper has a peculiar odor which can be perceived by moistening a copper coin with the finger. If nitric acid is added to metallic copper, it readily dissolves, and reddish vapors of nitrous oxide appear, which are easily seen by looking down the test-tube in which the test is performed. Potassium hydrate gives a greenish precipitate of copper hydrate, which is soluble in ammonia and in some organic substances, such as glycerin and tartaric acid. Ammonia in small amount produces a precipitate, but an excess redissolves the precipitate and gives an azure-blue solution. Sulphid of hydrogen precipitates black copper sulphid, which is readily soluble in nitric acid. Potassium ferrocyanid gives a reddish-brown precipitate of the ferrocyanid of copper, which is insoluble in hydrochloric acid. Metallic iron introduced into a solution of copper salts, previously acidified with hydrochloric acid, is coated with a deposit of metallic copper. The electrolytic decomposition of copper solution is readily accomplished by a galvanic current, and metallic copper thus obtained can be easily identified.

The **detection** of copper in organic mixtures is best performed by the test described under Arsenic. Copper sulphid after the removal of organic sulphids can be dissolved by the addition of a little hot dilute nitric acid, the solution evaporated to dryness, and the above tests applied.

IODIN

Iodin is used as a tincture and as Lugol's solution, and also in the form of many salts known as iodids, and in organic combinations as iodoform. Most cases of poisoning by iodin or its compounds are from accident or from negligence, due generally to mistaking these for some other medicine or by its injection into abscesses or by its external application to wounds.

Symptoms.—The symptoms produced by the ingestion of a single large dose are those of irritation or inflammation of the stomach and intestines, vomiting, or, perhaps, only nausea; the vomitus may be blue,

from the action of iodin on starchy matters. There is usually diarrhea, the stools are often colored with iodin and often with blood. There may be suppression of urine.

The symptoms produced by the too long continued use of iodin are excessive vomiting and purging, pain in the abdomen, heat and dryness of the throat, emaciation and a general febrile condition.

Treatment.—The stomach should be washed out with sodium hyposulphite and sodium carbonate, ice and opiates administered. The peculiar nasal catarrh caused by iodism is recognized by an eruption on the mucous membrane of the upper air-passages. Iodism can also be recognized by the detection of iodin in the urine.

Tests.—The most delicate test for free iodin is the addition of a few drops of a starch solution, which produces a deep blue color due to the formation of iodid of starch. This test is dependent upon the presence of free iodin, so that the blue color will not appear if the iodin is in combination with a base. In such cases it must be set free by a mineral acid or stronger halogen. The blue color disappears on gentle warming, reappearing on cooling. The addition of silver nitrate to a solution containing iodin produces a faintly yellow precipitate, insoluble in nitric acid and only very slightly soluble in ammonium hydrate.

IRON

Ferric chlorid and ferrous sulphate are the only salts that are of toxicological interest. Ferric chlorid is a yellowish-brown, amorphous body, deliquescent, with an acid reaction. Ferrous sulphate, commonly known as green vitriol, occurs in pale green, rhombic, prismatic needles, very soluble in water, with an astringent taste. On exposure these effloresce and are converted into basic ferric sulphate.

Iron preparations are largely used in medicine as tonics. These tonics are especially used in the various forms of anemia. Most of them pass through the system without being absorbed and are of very little therapeutic value, but they are so widely used that their administration may in certain cases lead to serious results, especially if given in large doses. The symptoms produced by the ingestion of medicines containing iron chlorid have often been serious. They are heat, dryness, and swelling of the throat, burning pain in the stomach and esophagus, and vomiting of blood. One case is reported where the patient was found "tossing about in the utmost consternation and agony; his tongue swollen and protruding from the mouth; his skin was parched and peeling off, while ropy mucus flowed from the mouth and nose; the eyes seemed starting from their sockets; the respiration was noisy and laborious, and suffocation seemed to be impending. During this time his hand was riveted to the region of the stomach as the principal seat of pain; the

palate and interior of the mouth were burned and presented a parboiled appearance."

Treatment.—Carbonate of soda in weak solution should be given immediately, and then removed from the stomach by means of the pump.

Iron is, as a rule, eliminated with the feces, and is distinguished in them by the appearance of a black color due to the formation of ferrous sulphid. A small portion only is excreted by the kidneys.

Tests.—Iron, as is well known, is a normal constituent of the body and of many foods. The intestinal secretions, as well as the gastric juice, the bile, and especially the saliva, contain considerable quantities of iron which comes mainly from the food ingested. Therefore, it is necessary in medico-legal analyses to isolate a considerable quantity to be of value as evidence. If the iron exists in the stomach and intestines in the form of sulphid or sulphate, it can be easily separated by treating with hydrochloric acid, when the filtrate will contain the iron which can be removed by the addition of ammonia after previous heating with nitric acid to convert it into the form of ferric salt. Sulphocyanid of potash gives a blood-red solution of sulphocyanid of iron which is not bleached by the addition of free mineral acids nor by a solution of mercuric chlorid. On the addition of sodium hydrate and potassium ferrocyanid and acidifying with hydrochloric acid, a dark blue precipitate of Prussian blue is formed. The sulphid of iron is insoluble in alkalies, soluble in dilute hydrochloric acid.

LEAD

The chief lead compounds that have been used for homicidal poisoning are the acetate and the subacetate. Other salts, such as the carbonate and the chromate, have often given rise to cases of poisoning, both acute and chronic, but rarely have they been fatal. The acetate, often called sugar of lead, is extensively used in the arts and manufactures, and the carbonate of lead, "white lead", is also very largely used in painting. Lead chromate and various lead oxids are used as pigments. Lead acetate is a white, crystalline body, efflorescent, soluble in water and alcohol (with a sweetish taste at first, later becoming metallic), and an acid reaction.

Lead Subacetate.—The basic lead acetate is formed when a solution of lead acetate is boiled with an excess of lead oxid. It is soluble in water and is present in some medicinal preparations, such as liquor plumbi subacetatis and Goulard's extract.

Lead carbonate is insoluble in water; it forms the base of many oily compounds known as white-lead paints, which are a mixture of this salt of lead and its hydrate. It is this compound of lead which is the most common cause of chronic poisoning.

Lead chromate and **lead oxid** are both insoluble in water, soluble in dilute vegetable acids and in hydrochloric acid.

Of the numerous cases of poisoning by lead, a few are reported as homicidal or suicidal. Most of them are accidental, either by mistaking lead for some other substance or by working in lead factories or paint shops. In those cases of criminal administration which have been reported, the acetate of lead was the compound used.

The principal sources of acute poisoning by lead are the two acetates, sugar of lead, and also carbonate of lead, white lead. Metallic lead itself is poisonous to animal life. The rapidity in the appearance of the symptoms in cases of lead poisoning depends upon the form in which the lead has been administered, as some salts are more easily dissolved than others.

In the manufacture of white lead as a pigment, the utmost care should be taken by the workmen to prevent the inhalation of lead dust, and where in the process of manufacturing, the dust is scattered in the air of the workroom, respirators should be used by the workmen. With care and watchfulness on the part of those employed, little fear need be had. Besides the use of respirators to prevent the dust from coming in contact with the mucous membranes of the respiratory tract, special attention should be given to the personal habits. No article of food or drink should be brought into the workroom where it is apt to be contaminated by the lead dust. The workman should thoroughly rinse out his mouth and throat and should not eat any food until he has thoroughly washed his hands, face and head, and changed his clothing. What has been said in reference to lead workers' habits applies equally well to painters and typesetters.

The use of lead pipes for conducting drinking water is another source of lead-poisoning, and the reason that there are not more often cases of such poisoning is due to the fact that hard waters generally cause deposits to form on the inner surface of the pipe, which prevents further action of the water upon it. All waters do not act equally upon lead pipe; as a rule, the purer the water, the greater the action, especially if it contains carbon dioxid and free oxygen. In those hard waters that contain alkaline sulphates or bicarbonates there is more action upon the lead. Lead cisterns should never be used for containing drinking-water. It is far better to use block tin in place of lead, to avoid the possibility of poisoning by this means.

Among the more common employments besides those already mentioned, where the use of lead may cause symptoms of poisoning, are working in lead mines in which lead ores are handled or the handling of lead compounds, in the case of glazers of porcelain, pottery ware manufactories, etc., the use of lead chromate or red lead as pigments, or the use of lead or any of its compounds in cooking utensils or articles

used for preserving foods, especially acid fruits and vegetables which are often put up in soldered tin cans. The acid contained in some of these, such as tomatoes, may easily remove a dangerous amount of lead from the solder. The cleaning of bottles with shot is not an uncommon source of chronic lead poisoning.

Acute Symptoms.—After the ingestion of lead there is first a more or less sweetish taste, and then an astringent or metallic taste; later there is often a sensation of burning and distress in the throat, extending down into the stomach. At other times there is a sense of weight at the pit of the stomach. The tongue is sometimes slightly swollen, is generally white, and is covered with small, prominent points. Nausea and vomiting may occur, and the first vomitus, of course, contains the lead. Later, mucus is vomited containing white patches due to the action of the lead salt. If chromate of lead has been taken, the vomitus is colored yellow. There are acute gastro-intestinal pains, often associated with constipation, although sometimes with diarrhea, in which the stools appear black from the lead sulphid which has been formed by the lead and the decomposition of the contents of the intestines.

The blue-black line which is so characteristic of chronic lead-poisoning is often absent in acute poisoning. If the poisoning is severe, the respiration becomes labored, accompanied by hiccough; vertigo may ensue and trismus or convulsions supervene, preceding a comatose condition which is followed by a fatal termination in a few days. Death from acute poisoning is not at all common, though the symptoms are severe. The ingestion of sugar of lead is followed soon by the appearance of symptoms such as above described; vomiting occurs usually within the first half-hour, but may be delayed for an hour or two; the vomited matter often contains streaks of blood. The colic produced by lead salts can usually be relieved by a swathe or pressure upon the abdomen. These symptoms are often accompanied by various nervous symptoms, such as headache, sharp pains in the limbs, and muscular cramps. When recovery takes place, convalescence is very slow, and the symptoms of lead poisoning may persist as long as a year.

In subacute poisoning, the secondary effects, after the first symptoms have passed away, may persist for a considerable time. In this form of poisoning the lead is absorbed into the tissues, and its presence deteriorates their nutrition and functions, hence we see more nervous disturbances and muscular changes accompanied by severe pain in the abdomen.

The patient is pale, emaciated and feeble, with a general feeling of lassitude. The presence of lead in the blood destroys the red blood-corpuscles, causing a severe anemia; later the lead is deposited in the

skin and mucous membrane, causing a dusky complexion, dullness of the eye-balls, and pallor of the mucous membranes generally. This appearance is often seen in those whose occupation requires them to handle the metal and where they respire an atmosphere in which various forms of lead are present. Plumbers are often subject to this form of poisoning and to chronic lead-poisoning.

Chronic poisoning by lead, or so-called saturnine intoxication or saturnism, often follows the ingestion of any lead salt, more especially after exposure to the ingestion of the metal itself by handling or by means of inhalation, as mentioned above. Gaucher, in an elaborate article on lead-poisoning, gives the result of his experience as follows: (1) Nutrition in lead intoxication is considerably retarded, as shown by the diminution of the solids in the urine; its sp. gr. is diminished, and the excretion of urea, chlorids, and phosphates lowered. (2) While the lead is in the system a large number of red blood-corpuscles are destroyed, and there is an abundant discharge of the coloring matters of the blood in the urine, causing a severe anemia. (3) The urinary secretion presents two distinct phases. At the beginning of lead-poisoning the urine is deficient in quantity, is concentrated, and has a high color, whereas later it becomes more abundant and normal, or even pale, in color. (4) Permanent albuminuria is not as common as the transitory form. (5) The elimination of substances not normal to organic life and which are usually absorbed, such as medicines, is retarded.

Symptoms.—The appearance of the blue line is a very important evidence of lead-poisoning, especially in the subacute and chronic forms, but it may not be present in those suffering from those forms of poisoning by lead, who are of cleanly habits and keep their teeth clean. The presence of this blue line is generally a positive indication of poisoning by lead, bismuth, or mercury. Its absence is merely of negative value. To determine whether it is caused by mercury or lead, an analysis of the saliva or urine must be made. This line (varying in color from a gray to a bluish-black and even black, according to its intensity) is about $\frac{1}{10}$ of an inch in width, and appears at the junction of the gums with the teeth. It is due to the deposition of lead sulphid which is formed by the contact of lead with the hydrogen sulphid which is so commonly present in the buccal cavity.

In chronic poisoning, in addition to this blue line, there are other discolorations of the mucous membrane, and patches on the inside of the lips and cheeks. The gums generally become thin and retracted, leaving the teeth prominent, and they often undergo decay. One must be on his guard not to confuse this appearance with a similar one which may occur in those employed in the manufacture of copper or who use

silver nitrate or iron solutions. The nature of the line can be easily distinguished chemically.

As the condition of chronic poisoning advances, the tongue becomes white and dry; there is loss of appetite and a feeling of heaviness in the stomach; later constipation, with pain in the back and frequent headache. These symptoms are nothing more than what is often met with in aggravated dyspepsia; but in lead-poisoning they may suddenly develop into an attack of colicky abdominal pain, preceded by albuminuria; these colicky pains, feeble at the beginning, increase and become almost intolerable. They are more persistent and obstinate to the ordinary forms of treatment than colic arising from other sources. Alcoholic excess increases the tendency to colic; also the drinking of vinegar.

Not only is lead deposited in the margins of the gums, but it may permeate throughout the whole body and be deposited in nerve-centers, in the brain, and in the kidneys.

Lethal Dose.—The lethal dose of lead or lead salts is difficult to determine, as it is dependent upon the rapidity with which it is absorbed and eliminated. Where diarrhea exists after administration, the drug passes out so quickly as not to produce its effects upon the tissues of the body. According to certain experiments, 8 grains of the acetate of lead injected into the veins of a dog will destroy its life in 24 hours. Recovery from 1½ ounces of the sugar of lead in a man has been recorded.

Treatment.—Weak solutions of sodium sulphate and epsom salts should be given, and the stomach-pump used to remove the insoluble lead sulphate which is formed. If necessary, opium may be given to relieve the pain and diarrhea. In subacute or chronic cases, potassium iodid should be given, which forms lead iodid in the tissues and thus renders the lead inert.

Postmortem Appearances.—The appearances postmortem, where the poisoning has been fatal, are, as a rule, very slight. In certain cases no anatomical changes of any importance have been noticed. Microscopic examination of the muscles generally reveals a change in the muscular fiber and an enlargement of their nucleoli.

Detection.—The detection of lead and the compounds of lead is very easy. Acid solutions of lead salts are precipitated black by hydrogen sulphid. This precipitate is easily soluble in nitric acid, but insoluble in hydrochloric or acetic acid. Lead salts in solution are precipitated by sodium carbonate, which precipitate is soluble in nitric or acetic acids with effervescence. Lead salts in solution are precipitated by dilute sulphuric acid, with the formation of lead sulphate, which is insoluble in nitric and hydrochloric acids, soluble in hot alkalies or alkaline carbonates. Potassium chromate gives a yellow precipitate of lead chromate, or chrome yellow, with a solution of lead salts. This

test serves to distinguish it from bismuth. The lead chlorid may be formed by the addition of hydrochloric acid, which is quite soluble in boiling water and crystallizes from it in long prisms. Also hydriodic acid and the soluble iodids cause a yellow precipitate which is soluble in boiling water.

Separation from Organic Matter.—The method is similar to that described under arsenic. Lead sulphid is freed from organic sulphids, the sulphids of antimony, tin, and arsenic, by washing with ammonia and ammonium sulphid. The black lead sulphid left upon the filter is dissolved in dilute nitric acid, and this solution evaporated to dryness, the residue dissolved in water, with the addition of a few drops of acetic acid if necessary, and with this solution the tests described above are performed. If bismuth or copper compounds are also present, the lead may be separated from them by the addition of sulphuric acid, which precipitates lead sulphate, decomposing this sulphate with hot sodium carbonate solution and dissolving the lead carbonate in acetic acid, and using this solution as above.

In cases of chronic poisoning and, to a certain extent, in those of acute poisoning, lead is found in the urine. The best method for its detection in these cases is to evaporate at least one quart to dryness after the previous addition of about 150 c.c. of pure, strong nitric acid; the residue is ignited in a porcelain crucible. The resulting white mass is then treated with concentrated sulphuric acid and warmed until all nitrous oxid fumes are expelled and sulphuric acid fumes appear, cooled, diluted with water, and boiled for a few minutes. It is again cooled and strong ammonia added until a permanent precipitate is just produced, which is then redissolved by an excess of acetic acid. The lead sulphate is then in solution in the presence of ammonia acetate containing an excess of acetic acid, and the lead may be precipitated by the action of hydrogen sulphid. This precipitate of lead sulphid is then collected on a filter, washed, dissolved in a very little dilute nitric acid, and this solution evaporated to dryness on a watch crystal on a water-bath, treated with a drop or two of ammonium hydrate to neutralize any acid remaining, and again evaporated. It is then dissolved in a few drops of warm water, with the addition of a drop of acetic acid, if necessary, and to the clear solution a few c.c. of moderately strong solution of potassium bichromate is added, and the whole allowed to stand 12 or 24 hours; the lead is precipitated as lead bichromate which may be collected at the apex of a very small filter, carefully washed, and a stream of hydrogen sulphid passed directly upon the precipitate on the filter. The precipitate, if it is lead bichromate, is coated with a layer of lead sulphid, and is seen as a brown or black deposit on the white filter after drying.

MERCURY

Metallic mercury is used in many of the arts. In olden times it was often used medicinally in the metallic form to remove intestinal obstruction, and but rarely were serious effects produced, even after the ingestion of large quantities. To-day, however, such administration is held by the laity to be dangerous.

The most common sources of poisoning by mercurial compounds are the two chlorids (calomel and corrosive sublimate) and the cyanid. *Calomel*, mercurous chlorid, is a heavy, white, tasteless body, insoluble in water, but more or less acted upon by the digestive fluids, and if retained in the system may produce severe symptoms. *Corrosive sublimate*, mercuric chlorid, is a white, crystalline substance, subliming at 82.2° C., soluble in cold water, freely soluble in hot water, and still more easily soluble in solutions of alkaline chlorids; it crystallizes in needles, octahedra, or plates, is soluble in alcohol and ether and many other organic solvents. With the albumen of the tissues it forms an insoluble albuminate of mercury. *Cyanid of mercury* is a white, colorless, crystalline body, soluble in alcohol and water. Cases of poisoning by this salt have generally shown symptoms of mercurial poisoning, rather than those of cyanid.

All forms and compounds of mercury are poisonous. Even metallic mercury when in a finely divided form, as it is in mercurial ointment or blue pill, can be readily absorbed from the surface of the skin or mucous membrane and give rise to symptoms of poisoning. Metallic mercury may cause chronic poisoning when inhaled in the form of vapor, as it is slowly volatile at ordinary temperatures. Workmen engaged in manufacturing articles involving its use, such as the separation of gold from its ore and the manufacture of mirrors and thermometers, are exposed to danger by inhaling its fumes.

Many of the medicinal preparations of mercury may give rise to cases of poisoning. Calomel, so freely used in medicine, may be contaminated with corrosive sublimate, which latter is more poisonous on account of its solubility.

Various compounds of mercury are mentioned in the U. S. P., mild mercurous chlorid (calomel), cyanid of mercury, red and yellow iodids of mercury, yellow and red oxids of mercury, mercury sulphate, and the red sulphid of mercury, white precipitate, compound cathartic pills, mercurial ointment, and many others.

Certain patent or quack medicines, such as the "Poor Man's Friend" (nitrate of mercury ointment), Brown's lozenges, and others contain mercury.

Absorption.—Mercury is easily absorbed by the skin and mucous surfaces, especially when mixed with fats or oils. In the state of

vapor it is easily absorbed by the air-passages, also by subcutaneous administration. Mercury may be absorbed when rubbed into the skin, especially when combined with fat, and so rapidly as to cause fatal poisoning. Workmen often suffer from mercurial poisoning, especially if the hands are not frequently washed.

Acute Poisoning.—The most common source of acute poisoning is the administration of corrosive sublimate. Almost immediately there is constriction of the throat, which may prevent the whole of the poison being taken, followed by a metallic taste in the mouth; vomiting of bloody liquid soon occurs, attended with violent purging, although the latter symptom may be absent. There is excessive pain in the epigastrium and burning and smarting in the throat; great thirst, followed by exhaustion and collapse, small and frequent pulse and difficult respiration; in many cases the urine is entirely suppressed or very scanty, and the duration in such cases is variable, death sometimes supervening in a few hours, other times not until after the lapse of many days. The symptoms of poisoning by corrosive sublimate closely resemble those by arsenic, but may be distinguished from the latter in that the action of mercuric chlorid is corrosive, while that of arsenic is irritating. Another symptom of differential diagnosis is that salivation is usually an early symptom in mercurial poisoning, but is absent in arsenical poisoning. An examination of the urine in such cases will often give the desired information.

Many cases apparently convalescing for the first few days after the administration of corrosive sublimate, may suddenly at about the seventh to tenth day, have a relapse and terminate fatally.

Chronic Poisoning.—In cases of slow or chronic poisoning by mercurial preparations, the symptoms of the corrosive action of the agent may be lacking, and there will be salivation with the appearance of a blue line on the margin of the gums, not unlike that caused by lead-poisoning. Usually the first symptom in a case of chronic poisoning by mercury is tenderness of the teeth, which is especially noticeable on bringing the jaws forcibly together; so that, where mercury is used for medicinal purposes in continued small doses, this should be looked for, and if such tenderness occurs, the administration of this agent should be discontinued temporarily. Sometimes looseness of the bowels occurs, even before the tenderness of the teeth. Other warning symptoms of chronic poisoning by mercury are great pallor and excessive weakness. This weakness progresses steadily, affecting first the upper limbs, later extending to the lower limbs, finally ending in general palsy. Pains in the abdominal region, accompanied by nausea and vomiting and a feeling of general malaise, may also be present. The salivary glands become tender and swollen and the mouth inflamed

and ulcerated. Serious salivation is the most prominent symptom and may even cause death. There is one fact to be observed in regard to mercurial treatment, namely, that the system can eliminate more easily and rapidly a single large dose of mercury than continued small doses frequently repeated, and that habitual constipation associated with continued mercurial treatment seriously interferes with the elimination of this drug.

That death may occasionally result from the action of mercury upon the mouth, there can be no doubt. It is extremely important, however, to know if this can be distinguished from those forms of inflammation and gangrene of some portion of the buccal cavity, which are the result of certain depressed and diseased conditions of the system independent of the action of mercury; also whether mercury given to a patient whose vital forces are thus reduced and whose blood is already poor, may not be the exciting cause by which gangrenous ulceration becomes developed. In the literature there are many cases where mercury in some form or other was given as a medicine, resulting in intense salivation, followed by extensive gangrene and sloughing, and finally death. As a rule, mercury does not produce salivation in children as rapidly as in adults.

Dr. Jackson has written a monograph on the subject, and we quote briefly from him:[1]

"First, the gangrenopsis attacks the cheek, the lip, and the nose, sometimes the face; most frequently in children, but sometimes in adults.

"Secondly, it begins in those soft parts, never in the maxilla, often where no mercury has been used, in a debilitated or febrile state of the system, as in idiopathic fevers or dysentery. Dr. Marshall Hall says: 'In all of the cases which came to my knowledge, this affection has been preceded by fever, acute disturbance of the digestive organs, inflammation of the lungs, variola, rubeola, or scarlatina. An exhausted state of vitality with cachectic fever is, therefore, the predisposing cause.'

"Third, the exciting cause is an injury done to the parts. I saw it evidently started by a child's lying continually on one side, with a hand under the cheek, thus pressing the mucous membrane against the molar tooth; the protuberance of this membrane being caught between the teeth was continually bruised, and the point of gangrene was thus established in an exanimate state of the whole system.

"Fourth, it is sometimes the result of a severe case of cancrum oris, the irritation spreading from the gums to the cheek."

In severe cases of mercurial stomatitis or sore mouth, the copious

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[1] Trans. Coll. Phys., Phila., U. S., Vol. II, No. 3.

and often bloody saliva is accompanied by very active pain in the submaxillary and other salivary glands. The teeth loosen and fall out in a few days, sometimes making the patient actually toothless. Along with these phenomena the grayish patches of the inflammation of the mouth invade the inner side of the cheeks, the margin and upper surface of the tongue, and below it, may be found fissures and more or less deep ulceration of the mucous membrane. The swelling of the tongue may become so extensive that it fills the whole cavity of the mouth, even causing it to project.

The differential diagnosis between true gangrene, stomatitis, or sore mouth, and mercurial stomatitis is easy of recognition even without the aid of chemical tests for the presence of mercury in the saliva. In natural gangrene the disease begins by ulceration without inflammatory action of the mucous glands, and without pain; while in mercurial stomatitis both are present. Other characteristic differences between these two diseases will be noted in what has been given above.

Lethal Dose.—The lethal dose varies more or less according to the idiosyncrasy, and sometimes from certain diseases of the organs of elimination, as mentioned above. Where corrosive sublimate produces its corrosive action upon the stomach and intestines, the result may be so serious as to threaten life. Fatal results may, therefore, follow an acute form of poisoning, and even in a chronic form, where these lesions may interfere with digestion. Fatal poisoning, according to Taylor, may follow from the ingestion of from 3 to 5 grains of corrosive sublimate. If prompt treatment after a poisonous dose is given, it may prevent fatal poisoning, even after much larger doses. Children have been killed by 3 grains. Taylor considers that the average fatal dose does not differ widely from that of arsenic, that is, 2 to 3 grains; but in some cases this dose has proved innocuous, as in certain cases of syphilis, where enormous doses have been given with impunity.

If vomiting occurs, white of egg in milk should be given immediately in order to produce an insoluble compound with the albumen.

The usual antidote is albumen in a large amount of water, but too much albumen causes a re-solution of the mercury.

Elimination.—The chief channel of elimination of mercury that has been absorbed into the system is through the kidneys, while the more insoluble mercurial compounds pass out of the system mainly in the feces and in the saliva. When these facts of elimination are considered, it may explain why in certain recorded cases of mercurial poisoning, said by some to have shown no evidence of the presence of poisoning by mercury, mercury has been detected in the tissues by chemical analysis. Mercury may exist in the system in small quantities, as the result of the habits of the individual during life.

POISONING BY MERCURY.

Death after six days. Partial hemorrhagic colitis with sloughing.

Chemical Examination.—By heat, corrosive sublimate is completely sublimed, but this is not necessarily indicative of mercuric chlorid. It is true also of arsenic and of mercurous chlorid, but the great solubility of corrosive sublimate, as compared with arsenic and the insoluble calomel, will differentiate it from these two substances. The addition of potassium hydrate changes corrosive sublimate to a yellow color, while arsenic undergoes no change, and calomel is turned black. A clean rag moistened with dilute hydrochloric acid and a bit of the powder under examination when rubbed on a clean plate of copper produces a silvery stain which readily volatilizes by heat, if we are dealing with corrosive sublimate. On fusion with sodium carbonate in a reduction tube, the mercury is sublimed in the form of minute globules on the closed sides of the tube.

In solution, corrosive sublimate may be isolated by hydrogen sulphid, forming a black precipitate which can be easily distinguished from the similar black precipitate of lead, copper, and bismuth by appropriate tests. Reinsch's test is performed similar to that for arsenic, the difference being in the end result. If we are dealing with metallic mercury, we will get metallic globules on the upper part of the tube. If a few small fragments of iodin be placed between two watch glasses in this tube and very gently heated, the iodin will unite with the mercury, forming mercuric iodid, which can be easily recognized by its color. The isolation of mercury from organic mixtures is accomplished by the same process as recommended for arsenic. After the removal of the organic sulphur compounds and any sulphid of arsenic, tin, or antimony that may be present, by dissolving them in ammonia water and ammonium sulphid, the mercuric sulphid will be left as a black precipitate on the filter. This should be then treated with hot dilute nitric acid, which will dissolve lead, copper, silver, and bismuth if present, but leave the sulphid of mercury, which may then be dissolved in aqua regia; this solution evaporated to dryness; the residue dissolved in water, and the resulting solution, which is one of corrosive sublimate, tested by appropriate tests.

PHOSPHORUS

Cases of phosphorus poisoning are mainly accidental, due to the ingestion of the phosphorus ends of matches by children. Some cases are caused by vermin exterminators which contain phosphorus and which are usually mixtures of such substances as meal or flour, with some flavoring matter to suit the taste of the animal for which they are intended.

Occurrence.—Ordinary commercial phosphorus exists in two forms—the transparent or common form which is poisonous, and the red phos-

phorus which, when pure, is not injurious. The white or poisonous variety is that which is usually employed in the manufacture of matches and vermin pastes. Matches are usually first dipped in an emulsion of sulphur and glue, and then the ends tipped with a mixture of phosphorus, coloring matter, as vermilion, an oxidizing material, as potassium chlorate, and glue. In the so-called safety matches, the phosphorus is generally placed upon the box instead of upon the match. When phosphorus has been administered criminally, the poison has generally been obtained by soaking the tips of the matches in some article of drink. Sometimes in these cases the matches have not been soaked long enough or the mixture has not been well stirred, in which case the phosphorus gravitates to the bottom of the vessel and if the matches have been soaked too long the phosphorus may become oxidized to phosphoric acid.

Strictly speaking, phosphorus exists in four forms, but two of these are rarely met with outside of the chemical laboratory; the usual forms being the first mentioned, the white or waxy form, and the red variety, these two being common articles of commerce. The white or waxy form is generally obtained in cylindrical sticks which have the consistence of wax and are kept under water to prevent oxidation. Great care must be exercised in handling it, as it causes severe burns if ignited. It has a garlicky odor, is only very slightly soluble in water, more so in alcohol, and freely soluble in carbon disulphid, ether, etc. It emits a feeble light in the dark, and when exposed to moist air, fumes of its oxid are given off.

Red phosphorus may be obtained by heating the white variety to 240°–280° C. in an atmosphere of carbon dioxid and washing the product with carbon disulphid to remove any trace of the waxy form. Pure red phosphorus is nonpoisonous; it is a reddish-brown, odorless, tasteless, noncrystalline substance, and ignites at a much higher temperature than the waxy form, at about 250° C. The so-called safety match generally has antimony sulphid instead of phosphorus, and red phosphorus is put upon the box.

There is one other compound of phosphorus which is very poisonous, namely, phosphine or phosphuretted hydrogen. It is formed by the action of nascent hydrogen upon phosphorus; it is a colorless gas, slightly soluble, and ordinarily inflames on contact with air. If mixed with hydrogen, it burns with a greenish flame which gives three characteristic absorption bands in the green on the spectrum.

In the reported cases of poisoning by this agent, most have been suicidal, with some homicidal and fewer accidental. The majority of the accidental cases are those of children caused by sucking the ends of matches.

Symptoms.—Phosphorus is a rather insidious poison, inasmuch as the symptoms may be delayed in their appearance and they are so widely divergent. The symptoms may be those of an irritant or they may affect the nervous system or the blood. Generally, in all cases there is some eructation of gas which has the taste of phosphorus, and if the mouth or throat be examined in the dark some luminosity will be observed. Severe symptoms may not occur for several hours. Later there is pain in the throat and a sensation of heat in the epigastrium; the tongue is swollen; there is nausea and vomiting; the vomitus usually is bloody, and if it contains free phosphorus it will be luminous in the dark. These symptoms are followed by colicky pains and diarrhea, with diffuse tenderness over the abdomen. The symptoms may persist for a few days, or even cease entirely and the patient appear to be convalescing when suddenly death supervenes. Even after the second or third day changes take place; there is headache, insomnia, retention of urine, the urine generally albuminous, and vomiting occurs irregularly; the stools are frequent, watery, and often involuntary; finally coma supervenes and death in from 6 to 12 days. These symptoms, which are perhaps the most common, resemble those of acute yellow atrophy of the liver. In other cases where the phosphorus apparently acts upon the nervous system, there is some soreness of the throat and pain in the epigastric region, with nausea; there also occur sensations of numbness in the limbs with cramps and continual fainting, and there is very great prostration. Delirium sets in later, followed by convulsive twitchings, coma, and death. In rare cases the phosphorus may affect the blood, destroying the blood-corpuscles and setting free the blood pigment. In these cases the action is, as a rule, slower and the vomitus is more apt to be bloody. There are also bloody stools, with tenesmus, and there is very great weakness and prostration. In a few days, after apparent convalescence, hemorrhages occur from the mucous membranes of the stomach, mouth, nose, and throat, the blood becomes more or less fluid, and extravasation takes place beneath the skin. Death ensues sometimes after the lapse of several months from exhaustion caused by the numerous hemorrhages.

In factories where phosphorus is handled cases of poisoning have occurred, but these can usually be prevented by proper attention to the hygiene of the employees. Those who have sound teeth are, as a rule, unaffected by necrosis of the teeth and jaw.

Lethal Dose.—One and one-half grains have caused death in a young man. In another case less than one grain given in the form of an emulsion proved fatal. This was probably due to the form in which the phosphorus was administered. In children the phosphorus on the ends of two matches has proved fatal.

The vapors of phosphorus have often caused symptoms of poisoning, especially among employees in poorly ventilated factories.

A peculiar accident is reported by Mr. Blyth. An employee was making matches, when the phosphorus took fire and exploded. The inhalation of the vapor of the phosphorus caused this man to fall unconscious, and he could not rise, having paralysis of the arms and legs. He was removed to the hospital, where after a while he could take a few staggering steps. The skin over the region of the spine was not sensitive to pressure nor to heat; his speech was somewhat thick, and the symptoms of paralysis increased for three years, when he died.

Treatment.—The best antidote for poisoning by phosphorus after the use of the stomach-pump is rancid oil of turpentine. Sulphate of copper should be avoided as an emetic, as it may cause severe gastro-enteritis.

Postmortem Appearances.—When pure phosphorus has been used alone or in combination with fat or oil, the esophagus and digestive tract are more often the seat of pathological alterations, which are chiefly gangrenous patches.

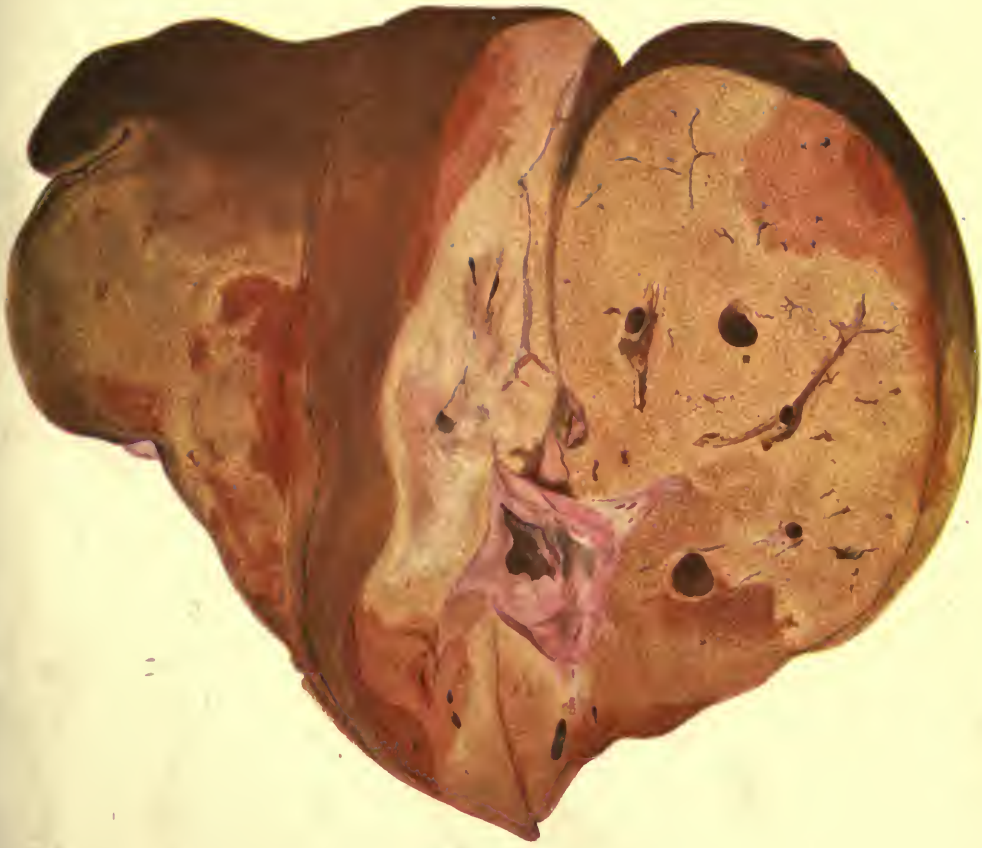
When the poison has been taken in the form of a paste or from matches, it often happens that no anatomical lesion is noticed, although there may be redness and small hemorrhagic points. On opening the abdomen the mesentery and peritoneum appear spotted with black ecchymoses analogous to the spots in purpura. The blood is liquid, without any noticeable change in the blood-corpuscles. The bladder often contains bloody urine.

Microscopical examination shows evidences of fatty degeneration of the liver, kidneys, heart, and muscles. These are not necessarily conclusive of phosphorus, as they may be caused by other means.

The contents of the stomach or vomitus may give a white vapor and be luminous in the dark, and if the autopsy is performed in a darkened place, similar vapors will be seen issuing from the rectum. Thus it seems that phosphorus may be absorbed into the blood, imparting its luminosity to the internal organs.

Certain cases, as mentioned above, fail to show any lesion postmortem; but this is probably due to the fact that careful microscopic examination was not made of the tissues.

Chemical Examination.—Various processes have been recommended for the isolation of phosphorus from organic mixtures, but the best method is that of Mitscherlich, which consists in distilling the suspected material previously diluted with water, if necessary, to the proper consistence, and acidifying with tartaric acid in a special apparatus called Mitscherlich's apparatus. In this apparatus the vapors arising on heating the flask pass through a small glass tube, at first vertical then horizontal and then downward. The descending portion of the tube is



POISONING BY PHOSPHORUS.

Death after eleven days. Acute parenchymatous degeneration of the liver with partial atrophy and marked jaundice.

inclosed in a cold-water jacket and ends in a beaker below. In this way the vapors, when they reach the cool portion of the tube, become condensed and are luminous in the dark. If the mixture suspected to contain phosphorus contain also alcohol, ether, or oil of turpentine, no luminosity will be observed, so long as these substances distill over. Alcohol and ether are soon separated on account of their volatility, and oil of turpentine, unless used as an antidote, would scarcely be present. Tartar emetic, castor oil, opium, albumen, and the organic acids do not interfere with the test. Iodin or mercury salts, such as calomel and corrosive sublimate, may interfere with the luminosity.

If the luminosity fails to appear when apparently one-third of the contents of the flask has been distilled, the condenser is removed and in its place is connected a U-tube filled with silver nitrate solution. Carbon dioxid is then passed through the apparatus for some time. If the silver nitrate remains unchanged, phosphorus is absent. If, however, the solution blackens, it must be tested for silver phosphid. For this purpose an ordinary Marsh's apparatus is used and after it is filled with hydrogen the black silver residue which has been filtered and washed is poured into the generating bottle. The gas at the exit is lighted and burns with a green flame if the black substance was silver phosphid. This green flame should be confirmed by examination with the spectroscope which will show three lines in the green if it is phosphin.

A preliminary test which may be employed in cases where phosphorus is suspected of being present is to treat a portion of the suspected substance, such as vomitus, with a little basic lead acetate solution in order to neutralize any hydrogen sulphid, and place the mixture in a tightly stoppered flask. A portion of this mixture is then placed in another flask, shaken vigorously with ether, and allowed to stand, tightly stoppered, for a few minutes; a piece of paper moistened with nitrate of silver should be then exposed to the action of the vapor in the upper portion of the flask, and the flask is then put in a cool, dark place. If only traces of the free phosphorus are present, the silver becomes blackened in a few minutes to one-half hour. This is only a preliminary test and must be confirmed in all cases by Mitscherlich's test, as described above.

POTASSIUM CHLORATE

Potassium chlorate has been the cause of a few deaths by poisoning. Its careless use in the treatment of local sore throat and diphtheria has caused several accidents.

The symptoms are intestinal irritation, with black stools; considerable urinary disturbance, with dark urine; great prostration; changes in the composition of the blood; cyanosis, feeble pulse, and difficulty in breathing.

Treatment.—The treatment should be directed to emptying the stomach of its contents and giving stimulants. Chlorate of potash is not only quickly absorbed by the mucous membranes, but also by broken skin, and is quite readily eliminated by the kidneys. Its action upon the coloring matter of the blood is proved; the hemoglobin is destroyed and the corpuscles are dissolved.

Postmortem Appearances.—The mucous membrane of the stomach is found swollen, soft, and easily detachable. The blood presents a chocolate color; the kidneys show evidence of marked irritation; the spleen is swollen and has the same characteristic coloring of the blood as have the kidneys.

Properties.—It crystallizes in colorless, rhombic tables without water of crystallization; it is readily soluble in water, slightly so in alcohol; on heating, it gives off oxygen, leaving potassium chlorid. Mixed with sulphur or sugar and rubbed in a mortar, it explodes, often with serious results.

Detection.—It can be separated from organic mixtures in the same manner as nitrate of potassium. (See p. 284.)

SILVER

Silver nitrate, known as lunar caustic, crystallizes in colorless, prismatic plates, which are very soluble in water. It has been the cause of a certain number of cases of accidental poisoning. Many hair dyes contain silver nitrate as do also many of the indelible inks. The symptoms are those of an irritant. White patches in the mouth, griping pains, purging, diarrhea, collapse, and unconsciousness.

In subacute and chronic poisoning, where silver nitrate or silver iodid has been prescribed for a long time in certain chronic nervous diseases, there is noticed a bluish complexion due probably to the deposit of finely divided metallic silver in the skin. This effect is more marked in those parts of the body exposed to sunlight, and it is not limited to the surface of the skin, but is also seen on the mucous membranes. At first the staining of the skin begins around the nails and fingers generally.

Lethal Dose.—Fifty grains have proved fatal to an adult.

Treatment.—Ordinary table salt, albuminous drinks, and milk are the proper antidotes.

Postmortem Appearances.—In acute cases the postmortem appearances are those of gastro-enteritis; in chronic cases ulceration of the esophagus and stomach, blackening of the renal glomeruli, of the villi of the small intestine, and medullary portion of the bones may occur.

Tests.—Soluble salts of silver when added to a soluble chlorid or hydrochloric acid precipitate silver chlorid as a white, curdy mass, which is soluble in ammonia, but insoluble in nitric acid. With potassium

iodid, soluble silver salts give a yellowish-white precipitate of silver iodid, insoluble in nitric acid, only very slightly soluble in ammonia; with potassium carbonate, a red precipitate; with hydrogen sulphid, a brownish-black precipitate, insoluble in ammonium sulphid and in dilute acids.

In the destruction of organic matter, as described under Arsenic and Lead, the silver is precipitated in the form of silver chlorid and will be found in the first residue. It can be purified from other substances in this residue after washing by a solution of ammonium hydrate, reprecipitated with hydrochloric acid, and identified by the above tests.

SODIUM, POTASSIUM, AND AMMONIUM SALTS

The neutral salts of sodium, potassium, and ammonium, such as the sulphate, chlorid, tartrate, citrate, and the halogen compounds, produce their poisonous effect on account of the alkaline radicle rather than the acid in combination. Potassium is the strongest and sodium the weakest of the three. Concentrated solutions of these various salts produce an entirely different action from ordinary dilute solutions given medicinally. Common table salt, sodium sulphate, and magnesium sulphate may produce fatal symptoms of a corrosive character when given in concentrated solution and brought in contact with the mucous membrane.

These neutral salts reduce the excitability and contractility of the heart of a frog to a marked degree; they produce slowing of the heart's action, irregularity, and finally cessation. When a potassium salt is injected into the blood of a warm-blooded animal, death occurs from arrest of the heart's action. Subcutaneous injection causes a retardation of the pulse and heart, difficult respiration, and convulsions ending in death. Smaller doses will produce a temporary lessening of the arterial pressure, followed later by an increase in the blood-pressure. These neutral salts are eliminated by the kidneys.

Potassium sulphate has caused many cases of poisoning on account of its use in many puerperal conditions. Accidents have attended its use on account of the impurities contained in it, such as zinc, copper, corrosive sublimate, and potassium oxalate. The symptoms are those of an irritant: severe pain, burning sensation in the stomach and abdomen, nausea, vomiting, purging, cramps, etc.

Cream of tartar (potassium bitartrate) and potassium sulphate have produced death when taken in concentrated large doses.

Potassium nitrate, commonly called "saltpeter", is a common remedy in household use. It has often been mistaken for magnesium sulphate or sodium sulphate in its use as a purgative. Death has been caused by

from 1 to 1½ ounces, in which the symptoms were those of a violent local irritant.

Potassium nitrate occurs as colorless prismatic crystals, free from water of crystallization. They decrepitate upon being heated, are readily soluble in water, slightly so in alcohol.

In cases of suspected poisoning by these substances, an ANALYSIS of the urine during life is important, as they are quickly eliminated by the kidneys. In examining organic mixtures for potassium nitrate, they should be evaporated to dryness, extracted with a small quantity of hot water, filtered, and the filtrate tested for the presence of potassium nitrate. If we suspect the case to be one of poisoning by potassium sulphate, the same method of isolation will do. In this case the residue is extracted with alcohol which removes any impurity, leaving the potassium sulphate behind; this can then be dissolved in distilled water, and the solution tested both for sulphuric acid and potassium.

Postmortem Appearances.—In cases of poisoning by potassium nitrate, we find an inflamed condition of the stomach, darkened mucous membranes, which are also softened and easily torn, and the contents of the stomach often mixed with blood. Perforation rarely occurs.

Treatment.—The stomach should be emptied by the stomach-pump or by mild emetics, and stimulants given to strengthen the heart's action, with local applications of heat to the surface of the body.

TIN

Tin is commonly used in soldering tin cans used for preserving meats, fruits, and other articles of diet, and it is doubtful if it can serve as a source of poisoning in these cases. Tin chlorid has given rise to accidental poisoning in the case of an old man who dried some wet salt in a tin dish upon the stove and then ate some meat and bread with which he had wiped the dish. He was attacked with a febrile condition, in which the most marked symptoms were salivation, extreme fetor of the breath, and discoloration of the gums; the tongue and the inside of his cheeks were covered with ulcers. Most cases reported of poisoning by solder are probably due to the use of cheap solder wherein lead is substituted for tin, and the symptoms produced are similar to those described under poisoning by Lead.

In cases where tin salts have been ingested, there have been severe symptoms of poisoning of an irritant nature. These were nausea, accompanied by a metallic taste in the mouth; abdominal pains followed by vomiting and diarrhea; collapse, with feeble and irregular pulse, muscular cramps, and albuminuria.

The stomach should be emptied by a mild cathartic and by the stomach-pump. Alcoholic stimulants should be given to counteract

the collapse, and the pain may be eased by the administration of opium.

Detection.—The detection of tin is accomplished by a method similar to that used for arsenic. After the treatment of the sulphid precipitate with ammonium hydrate and ammonium sulphid, the tin will be found in the filtrate. This solution, after the removal of organic sulphur compounds by nitric acid and evaporation, can be used for the following tests: With sulphid of hydrogen, stannous salts give a brown precipitate of stannous sulphid. With alkalies stannous salts give a white precipitate, soluble in an excess of the reagent, but on boiling precipitate the black oxid. With hydrogen sulphid stannic salts are precipitated yellow. Stannic salts with fixed alkalies give a white precipitate, soluble in an excess of the reagent, but not reprecipitated by boiling. Mercuric chlorid gives a gray deposit of mercury.

ZINC

Zinc oxid has been the cause of a few cases of poisoning, especially of professional poisoning, where it has been used in the place of white lead. In one case that was reported of poisoning caused by breathing an atmosphere loaded with zinc oxid powder, the workman was attacked with vomiting, colic, and constipation. These symptoms persisted and increased so much that he rolled on the floor in agony. The vomited matters were bilious; he rejected his food almost immediately after swallowing it, and was constipated for several days. He was cured by remedies usually employed for painters' colic.

Zinc oxid is very apt to be contaminated with lead and arsenic, and it is highly probable that many of the symptoms attributed to poisoning by zinc are really due to foreign metals contained in it.

Zinc chlorid and zinc sulphate have also caused symptoms of poisoning from their use in soldering fluids. In fact, such soldering fluids have been used for suicidal purposes in many cases.

Sulphate of zinc, commonly known as white vitriol, is a white, crystalline solid, soluble in water, slightly soluble in alcohol. Its solution has an acid reaction and a burning, astringent taste. It is extensively used in medicine as an astringent and as an emetic. Often it is given as an emetic where the physician desires to remove other poisons from the stomach, and he never thinks that he is giving another poison by such treatment.

Zinc chlorid is a constituent of many disinfectants and of injection fluids used for preserving bodies. It is a white substance, very soluble in water and deliquescent. It has been the cause of subacute poisoning, in which cases there has been gastro-intestinal irritation, followed by diarrhea and severe nervous symptoms, such as spasms of the muscles

and impaired sight. Other symptoms are gastric catarrh, pains in the forehead, and sweating.

One case resulting fatally showed the following **postmortem appearances:** Lividity of the skin; congestion of the brain and its membranes; congestion of the lungs; the inner surface of the stomach covered with yellow pultaceous matter, on the removal of which a uniform, yellow color was observed except near the greater curvature, where it was reddish. The small intestine was somewhat injected and contained yellowish matters.

Cases of subacute and chronic poisoning show constriction of the esophagus and of the cardiac end of the stomach, often accompanied by ulceration at the pylorus and occasionally by perforation.

Detection.—The detection of zinc is easily accomplished. Ammonium sulphid gives a white precipitate, as well as hydrogen sulphid, when there are no free acids present. Ammonium carbonate precipitates zinc carbonate, which is also white and readily dissolves in an excess of the reagent. Potassium ferrocyanid also gives a white precipitate. The ammonium sulphid test is the most characteristic, as it is the only white metallic sulphid that is thrown down by ammonia.

CHAPTER IV.

ORGANIC POISONS

ACETIC ACID

Acetic acid is manufactured for commercial purposes by the destructive distillation of wood. Glacial acetic acid is a colorless liquid at ordinary temperatures, with a strong, pungent odor and bitter taste, soluble in alcohol, ether, and water in all proportions. It crystallizes at 17° and boils at 119° C. Most cases of poisoning by this acid have been caused by accident or ignorance. The dilute acetic acid of the U. S. P. can apparently be taken in large quantities without danger to life, although we often hear of chronic poisoning caused by the daily use of vinegar or weak acid by hysterical women for the purpose of blanching the complexion. It is more probable, however, that anemic persons who practice this injurious habit, crave an acid to relieve their restlessness, and thus prevent the natural desire for wholesome food.

Symptoms of acute poisoning by glacial acetic acid are those of a corrosive upon the inner surface of the mouth, throat and alimentary canal; pain in the epigastrium, vomiting of a liquid smelling strongly of the acid, difficult respiration, and the expectoration of large quantities of mucus. Later, there may be signs of pneumonia which, if the patient is to recover, will disappear in the course of a week or ten days. If a fatal dose has been swallowed, the corrosive effect upon the mucous surface of the stomach may produce collapse and convulsions. If the acid has been drawn into the respiratory organs, edema of the glottis may arise, causing speedy death from asphyxia.

The peculiar odor of acetic acid will show the presence of this substance; also its presence in the vomitus and the signs of its local action upon the mucous membrane.

Treatment.—Magnesia may be administered in a large amount of water to counteract the caustic action on the mucous membrane. Tracheotomy may be necessary where there is edema of the glottis and obstruction of the air-passages.

It must be borne in mind that acetic acid in the form of vinegar is a common article of diet, and that its mere presence is not proof positive of criminal administration. Hence, to be of legal value, large quantities of it must be isolated. The material is best distilled, after acidifying with tartaric acid, in the presence of carbon dioxid; the distillate can then be

tested for acetic acid and its presence confirmed. It blackens when warmed with sulphuric acid; silver nitrate forms a white, crystalline body, somewhat soluble in water, but not reduced on boiling. Ferric chlorid in neutral solution give a deep red color, which on boiling produces a precipitate of basic acetate of iron.

ALCOHOL

By the term alcohol we usually confine ourselves to the ordinary compound, ethyl alcohol, treating the other alcohols, such as methyl and amyl alcohol, under their full names.

Ethyl alcohol is made from various saccharine liquids by the action of various varieties of yeast. By this process, most of the sugar employed is converted into alcohol, the remaining part being transformed into bodies, such as fusel oil, etc.

The various alcoholic beverages contain widely divergent amounts of alcohol. The malt liquors, such as beer, ale, porter, and stout, contain from 1 to 9%. Grape juice, producing light wines, contains less than 12%, and the heavy wines, such as port, sherry, etc., contain from 16 to 25%. The so-called "spirits," such as brandy, whisky, gin, etc., contain from 40 to 60%. These are obtained by distillation. Fortified wines are, as a rule, heavy wines which have been fortified by the direct addition of alcohol. Fusel oil is a mixture of the various higher alcohols, chief of which is amyl alcohol.

Absolute alcohol is a colorless, volatile liquid, with a characteristic odor and burning taste. It burns with a non-luminous flame, is very hygroscopic, and is miscible with water in all proportions. It is neutral to litmus. Ordinary alcohol is a solution of absolute alcohol in water, of varying strength, according to circumstances, usually 95%.

The injurious effects of the abuse of alcohol upon the human system are too well known. The poisonous action when taken into the system in large quantities is so different from that where it is taken in larger or smaller doses, often repeated, that we will speak more in detail of this condition. Death has occurred in a short time from the ingestion of a large quantity of liquor, as is well known. One case is reported where a woman died in half an hour after swallowing the contents of a bottle of gin. In general, the state of stupor is preceded by a short period of excitement, although this preliminary stage may be absent. The ingestion of large quantities of liquor in various forms has caused many sudden deaths, not only in those who are to a certain extent used to its effects, but also in those who are strangers to it. Such instances are seen occasionally as a result of a wager. The victim falls as if struck down. There is profound coma, often accompanied by slight convulsive shocks; respiration becomes more and more diffi-

cult, and froth appears at the lips; involuntary evacuations may occur and a fatal result may ensue within an hour, or even fifteen minutes.

Several cases are reported by the Medical Examiners of Massachusetts. One where a half-witted man drank a large quantity of whisky and was found dead twelve hours later. Another, where a woman drank a dipper full of raw brandy and died in fifteen and one-half hours. Another, of a man who drank a pint of whisky and died in ten minutes.

The **general symptoms** of the comatose condition are as follows: the face is either pallid or flushed; the pupils at first contracted, later dilate, and are unaffected by light; the respiration slow and often stertorous; the pulse weak, the limbs cold and relaxed. In other words, the appearance is similar to that of poisoning by opium, or even that of apoplexy. The odor of the breath may assist in diagnosis, although the odor may be present without the alcohol being the cause of the condition. Often death may ensue without the physician being able to distinguish between alcoholic poisoning and opium poisoning or fractured skull. Even postmortem nothing may be found to assist in the diagnosis. Chemically, we can determine that alcohol was the cause of death only when a considerable quantity of alcohol can be recovered from the tissues.

A detailed account of alcoholic poisoning has been described by Dr. G. K. Sabine in a paper[1] on the "Medico-legal Relations of Alcoholism: its Pathological Aspects." We print herewith an extract from it.

"**Acute Alcoholic Poisoning.**—The pathological anatomist meets with two classes of cases of alcohol poisoning, the acute and the chronic. The former is not unfrequently the immediate cause of death, the latter rarely so. That fatal cases from acute poisoning are not so rare as might be supposed is shown by the fact, mentioned by Taylor, that in four years (1863–1867) thirty-five deaths from this source occurred in England and Wales alone.[2]

"In describing the postmortem appearances it will be necessary to describe those belonging to the two classes separately. The statements of different observers vary greatly in regard to these appearances, and in many respects are entirely contradictory. This is due, no doubt, to the want of making a proper distinction between the acute and the chronic forms, many symptoms thus being considered as due to acute poisoning which are in reality met with in chronic cases only.

"Within a short time effects of the different kinds of alcohol in poisonous doses upon dogs have been thoroughly investigated by Dujardin-Beaumetz and Audigé. These investigations were carried on by means of more than two hundred and fifty experiments upon as many different animals, and the general conclusions drawn from them were as follows:

"In animals which succumb to acute alcoholic poisoning, anatomical

[1] Trans. Mass. Med. Leg. Soc., 1880.

[2] H. C. Wood, "Therapeutics, Materia Medica, and Toxicology."

lesions are constantly found, which vary in intensity with the strength of the alcohol. These lesions occur especially in (1) the digestive organs; (2) the circulatory and respiratory organs; (3) the nervous system, and (4) the kidneys.

"'(1) Lesions of the Digestive Organs.—In regard to the stomach, the changes are less marked when the alcohol has been administered subcutaneously, and then only a slight redness toward the pyloric extremity is perceptible; but when the alcohol is administered by the esophagus, the lesion is more marked and, in certain cases, the mucous membrane is more or less softened. The effects depend on the strength of the alcohol, being much more marked when the alcohol is concentrated, and therefore more caustic.

"'The alteration in the small intestine is more constant and more marked where the alcohol has been administered hypodermically. It exists more especially in the upper part of the intestines; but when death is protracted, it occurs throughout its whole length. The intestinal mucous membrane is then softened, its surface of a dark red color, and it presents, in the majority of cases, more or less abundant hemorrhages. These appearances may be accounted for by the elimination of the alcohol by the intestinal glands.

"'In the large intestine a hemorrhagic appearance is met with, especially toward its inferior extremity and on the longitudinal bands.

"'The liver is the gland most seriously affected in acute alcoholic poisoning; this organ, although very quickly congested, is soft throughout and friable; it can be torn between the fingers, and the hepatic cells can be destroyed, in a great measure. The spleen is also engorged with blood and its tissue softened. Finally, in a certain number of cases, the head of the pancreas is found to share in the congestion presented by the duodenum.

"'(2) Lesions of the Circulatory and Respiratory Organs.—In acute alcoholic poisoning the blood is essentially altered; it is blackish and forms more or less abundant clots in the heart. The pulmonary lesions are characterized by a distention of the vascular system. This congestion is frequently more marked when the alcohol has been introduced by the stomach, and in these cases there are ecchymoses at the base of the lungs.

"'(3) Lesions of the Nervous System.—Lesions of the cerebrospinal axis are characterized by considerable venous congestion of the meninges. In the brain, the veins and sinuses are engorged with blood, and the gray matter is also somewhat congested. These cerebral lesions are more pronounced, the longer the comatose period continues.

"'(4) Lesions of the Kidneys.—These lesions are but slightly marked when caused by fermented alcohol, but when due to œnanthylic or caprylic alcohol, are more pronounced. But it is, above all, in acute glycerin poisoning that they attain their greatest intensity; there exists then, not only a congestion of the organs, but a certain quantity of blood is found in the bladder.'

"Lallemand, Perrin, and Duroy (Alcohol et des Anesthésiques) state that 'marked anatomical changes are found in animals which have died from the administration of alcohol. The mucous membrane of the stomach and of the upper part of the small intestine is inflamed, sometimes quite violently. The liver is much congested. The lungs

show no sign of asphyxia or even real congestion. The right side of the heart and the large veins are filled with very liquid dark blood. The meninges are engorged with blood. The alcohol is diffused through all the tissues and secretions; but the brain, cord, and liver contain a much larger proportion than any of the other tissues.'

"So much for poisoning in the lower animals.

"*Alcohol Poisoning in Man*

"On inspection, the dependent portions of the body are found discolored by hypostatic congestion. It has been claimed by some that decomposition sets in very slowly, but this is denied by others.

"'The general appearances resemble more or less closely those of asphyxia, the right side of the heart, the pulmonary arteries, and the systemic veins being loaded with blood, while the left cavities and the arterial system are comparatively empty, the blood which they do contain being dark.[1] The sinuses and the whole venous system of the brain are turgid with dark blood.'[2]

"The blood is very fluid or imperfectly coagulated and of a dark color.[3]

"The mucous membrane of the stomach is usually found very much injected, as indicated by a bright[4] or deep-red[5] color, covered with coagulated mucus (albumin),[6] and sometimes ecchymosed.[7] The congestion usually extends both into the esophagus and into the small intestine.[8]

"The action of strong alcoholic liquid on the mucous membrane of the stomach so closely resembles the effects produced by arsenic and other irritants as easily to give rise to the suspicion of mineral irritant poisoning.[9]

"The amount of alteration in the gastric mucous membrane will vary, of course, with the quantity of alcohol taken, its degree of concentration, and the amount of food, etc., in the stomach.

"A very few cases have been reported in which the mucous coat has been found in a sloughing condition. According to Baer, frequently no lesions are perceptible. In such cases, the fluid has been taken very much diluted.

"Alcohol is found to be present in the contents of the stomach in variable quantity, or entirely absent[10] from the same, according to the quantity ingested, the rapidity of absorption, and the time which has elapsed between the last potations and the death of the individual.

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[1] Carpenter on "Alcohol."

[2] Woodman and Tidy, "Forensic Medicine and Toxicology"; Carpenter on Alcohol."

[3] Casper, "Forensic Medicine," Vol. II.

[4] Taylor on "Poisons"; Christison on "Poisons"; Birch-Hirschfeld, "Lehrbuch der pathologischen Anatomie."

[5] Wood, "Therapeutics, Materia Medica, and Toxicology"; John J. Reese, "Manual of Toxicology"; Oesterlen, "Heilmittellehre"; Taylor on "Poisons"; Woodman and Tidy, "Forensic Medicine and Toxicology"; Birch-Hirschfeld, "Lehrbuch der pathologischen Anatomie."

[6] Oesterlen, "Heilmittellehre."

[7] Wood, "Therapeutics, Materia Medica, and Toxicology"; Oesterlen, "Heilmittellehre"; Birch-Hirschfeld, "Lehrbuch der pathologischen Anatomie."

[8] Woodman and Tidy, "Forensic Medicine and Toxicology."

[9] Taylor on "Poisons."

[10] Oesterlen, "Heilmittellehre."

"The length of time that portions of it may remain in the stomach is consequently very uncertain. Taylor mentions a case in which a pint of spirits was taken and a fatal effect produced in eight hours, but no traces of it could be detected in the stomach. That it may entirely disappear from the stomach long before it is eliminated from the other organs is proved by a number of cases in more or less chronic poisoning related by Magnan. In one of these three days and six hours had been passed without excess in drink; the liver and brain contained alcohol, but none was found in the blood or other organs. In another patient who had died fifty hours after his last potation, alcohol was found in the liver, brain, and blood in very appreciable quantity; the lungs also contained traces.

"When present, as it probably almost always is,[1] at the time of death, in cases of acute poisoning, the contents of the stomach will, of course, possess the odor of the liquid ingested, unless masked by some other substance present.

"The mucous membrane of the respiratory tract exhibits a widely spread and intense injection of the blood-vessels;[2] the bronchi are filled with frothy mucus;[3] more or less hyperemia of the lungs may always be expected;[4] they are very often found in a state of edema; still more frequently hypostases and hepatization are discovered in their posterior and inferior portions.[5]

"The liver, kidneys, and spleen are usually found loaded with venous blood.[6]

"The presence of alcohol may be detected in the liver even after it has entirely disappeared from the stomach and all the other organs, with the exception of the brain; for it is these two organs that show the greatest affinity for it.[7]

"Nearly all authorities state that all the veins of the cerebrum and cerebellum, together with their membranes, are engorged with blood.[8] According to Birch-Hirschfeld, however, the substance of the brain itself is frequently found anemic and edematous.

"According to some, an effusion of serum[9] is frequently found within the ventricles or beneath the arachnoid and, according to many others, an effusion of blood[10] is very apt to take place, especially in the latter locality. It is probably somewhat doubtful how frequently these

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[1] Christison on "Poisons."

[2] Boehm, Ziemssen.

[3] Carpenter on "Alcohol."

[4] John J. Reese, "Manual of Toxicology"; Casper's "Forensic Medicine"; Woodman and Tidy, "Forensic Medicine and Toxicology"; Wharton and Stillé's "Medical Jurisprudence"; Lallemand, Perrin, et Duroy, "Alcohol et des Anesthésiques."

[5] Boehm, Ziemssen.

[6] Carpenter on "Alcohol."

[7] John J. Reese, "Manual of Toxicology."

[8] Oesterlen, "Heilmittellehre"; John J. Reese, "Manual of Toxicology"; Wharton and Stillé's "Medical Jurisprudence," Part I.; Casper's "Forensic Medicine"; Taylor, "Treatise on Poisons"; Birch-Hirschfeld, "Lehrbuch der Pathologischen Anatomie"; Lallemand, Perrin, et Duroy, "Alcohol et des Anesthésiques."

[9] Oesterlen, "Heilmittellehre"; Carpenter on "Alcohol"; Taylor on "Poisons"; John J. Reese, "Manual of Toxicology."

[10] Wharton and Stillé's "Medical Jurisprudence"; Tardieu, "Etude sur l'Empoisonnement"; Taylor on "Poisons"; Woodman and Tidy, "Forensic Medicine and Toxicology"; Christison, "Treatise on Poisons."

effusions take place in the most acute cases. The statement that hemorrhagic apoplexy occurs quite constantly seems to be founded on a very limited number of cases.

"Through the kindness of Dr. Harris and Dr. Amory, of this society, I have been enabled to obtain the autopsy records of two cases of undoubted acute alcohol poisoning which fell into their hands for examination; and Dr. Wood, of the Medical School, has kindly furnished me with an account of the chemical analyses in the same cases. Dr. Draper has also published an account of an examination of a more or less chronic case, in the Transactions of this society, Vol. I., No. 1.

"Dr. Harris's Case.—Two women of bad character were induced in the evening by two sailors to go on board a vessel lying at one of the wharves, where they drank a large quantity of Spanish rum, known as aguardiente. At two in the morning, one of the women was found dead.

"Autopsy fourteen hours after death. Rigor mortis marked. Lividity of dependent portions of the body. An abrasion of the mucous membrane in the lower part of the vagina, 1½ inches, was discovered. No marks of violence.

"*Section.*—The lungs were bound to the chest walls—especially posteriorly—by not very firm adhesions. The heart presented no very unusual appearances, except that the muscle was a little lighter colored than usual. The abdomen contained about one ounce of dark colored fluid. The lungs were slightly congested and the bronchi contained a little frothy mucus.

"The kidneys were firm, quite dark in color, with the pyramids very strongly marked. The internal surface of the stomach was intensely congested, the contents (about two ounces) smelling very strongly of rum. The brain was of normal consistence, the vessels of the pia mater not overloaded; the puncta cruenta were, however, strongly marked. The uterus contained free dark blood, and in the right ovary was a corpus luteum of menstruation. The intestines and bladder presented nothing unusual. The spleen presented appearances of old inflammation. The liver, brain, stomach and contents were reserved for chemical analysis; the kidneys, part of heart, and uterus for microscopical examination.

"Dr. Wood isolated from the contents of the stomach ½ c.c. of alcohol, 0.825 specific gravity, which contained 89 per cent. of absolute alcohol, and from a half of the brain 2 c.c. of alcohol of the same strength. This corresponds to 4 c.c. in the whole brain; and since 89 per cent. is about double the strength of ordinary spirituous liquors, the amount found in the brain corresponds to about 8 c.c. of ordinary liquor.

"Dr. Amory's Case.—A man about forty-two years old left, home in the company of a friend. Two hours later, after visiting a number of places where liquor was sold and drinking freely, he was brought home in a comatose condition and died shortly after.

"Autopsy seven hours after death. Body well developed. Face livid. A superficial cut just beneath the left orbital ridge, from which a small quantity of blood was slowly oozing. Thick layer of fat under the skin. The deceased wore a truss for double inguinal hernia. Left inguinal canal open, the right closed. Diaphragm on the right side opposite the fourth rib, and opposite the fifth on the left. Pigmentary

deposits in both lungs. Old pleuritic adhesions on the posterior surface of right lung, chiefly confined to the lower lobe. Pericardium contained about a half-ounce of serum. Left ventricle contracted, right flaccid. Mitral valve admitted two fingers with difficulty, tricuspid three fingers readily. No clots in heart or large vessels. The posterior portion of the right lung engorged with blood, but pressure caused crepitation. A small cyst about the size of a pea on the periphery of the right kidney. The external surface of the stomach considerably congested, the internal intensely reddened, showing the action of some irritant substance. The rugæ quite prominent. The contents consisted of fragments of meat, potatoes, and carrots, and about 1½ pints (by estimate) of fluid smelling of alcohol. No clot found in any part of the body or blood-vessels. Vessels of the pia mater moderately filled with blood.

"Dr. Wood isolated from the contents of the stomach 33⅓ c.c. of 89 per cent. alcohol, and about ½ c.c. of the same strength from one half of the brain.

"The medical examiner meets with another class of cases much more frequently than with the preceding. These are cases in which the subjects have been addicted for a long time, during life, to alcoholic excess, and have died during a debauch, the immediate cause of death being either some exposure to cold, some chronic disease caused by the long continued use of alcohol, or the continued dose of alcohol in a system already much weakened by its excessive use.

"In these cases one is apt to meet with certain appearances which belong to cases of acute poisoning, if alcohol has been recently taken, such as redness of the gastric mucous membrane, fluidity of the blood, etc., and either few or many of the signs of chronic poisoning may also be present, but no one of them is constant or pathognomonic."

Chronic alcoholic poisoning is often caused by alcohol, and the following symptoms may be noticed: catarrhal inflammation of the mouth; fatty degeneration of the liver, the liver at first enlarged, later cirrhotic; the blood-vessels are fatty, the kidneys degenerated, and there is a decrease in the visual faculties and in the intelligence. Later, delirium tremens and collapse. Chronic alcoholism is more a subject for the medical practitioner than for the toxicologist. The postmortem appearances may mask a doubtful case of suspected poisoning, and we would refer the reader to an article by Dr. G. K. Sabine in the "Transactions of the Massachusetts Medico-Legal Society," Vol. I., No. 5, 1882, from which the following is abstracted:

"*The Medico-legal Relations of Chronic Alcoholism, and its Pathological Aspects.*

"Although the acute form of alcoholic poisoning is not infrequently the immediate cause of death, and the chronic alone rarely so, the two are so often combined that the signs of the latter should be familiar to the medical examiner.

"Of all the various conditions that are attributed to the habitual use of alcohol, but very few, if any, are pathognomonic. The statements

of different observers vary greatly in regard to the postmortem appearances of the chronic, as well as of the acute form, and the question to what degree certain diseases may be attributed to this form of poisoning remains an open one. In fact, almost every known chronic affection has been attributed, some time or other, to the intemperate use of alcohol. It is probably the fact that the remote is frequently looked upon as the immediate cause. That the habitual and long-continued use of alcohol so alters the tissues and impairs their functions that they are more prone to become diseased, there can be no doubt.

"Perhaps there is no question which the medical examiner is more frequently called upon to decide than whether or not he has to deal with a subject who has been an habitual drunkard.

"Although no single pathological condition is sufficient to determine this positively, yet there are certain ones which point strongly in this direction, and the same inference can be drawn from others, taken collectively, which are almost equally conclusive. . . . "

Action.—Alcohol is a strong dehydrating agent, producing inflammation of the skin, especially where the skin is protected from the air. Its local action is also irritating to the mucous membrane, causing nausea and vomiting. Its elimination is largely through the lungs, although a small part is excreted by the kidneys. In small quantities it retards tissue waste and may be considered of food value. It is rapidly absorbed into the tissues of the body, even into the fetal circulation and into the milk of the mother. Where death has occurred from the ingestion of large quantities of alcohol, it is probably due to paralysis of the respiratory centers.

Tests.—With sulphuric acid and potassium bichromate, alcohol gives a green color and the peculiar odor of ethyl aldehyd. Shaking with benzoyl chlorid and potassium hydrate, the characteristic odor of ethyl benzoylate is formed, and a blue color is developed on the addition of guaiac, hydrocyanic acid, and copper sulphate. Acetic ether, which can be recognized by its odor, is formed in the presence of sulphuric acid and sodium acetate.

Isolation.—To recover alcohol from organic mixtures, it should be distilled over a water-bath. If acid, the mixture should be rendered neutral with sodium carbonate and then acidified with tartaric acid. The distillate is more or less impure dilute alcohol. It can be purified by repeated distillation and the amount determined by the specific gravity.

Amyl Alcohol

Fusel oil, which is mainly impure amyl alcohol, has caused a few cases of poisoning, and as this substance occurs in traces in many liquors, it has been considered the cause of many of the symptoms of chronic alcoholism.

The **chief symptom** of acute poisoning is unconsciousness, lasting

several hours; glycuronic acid appears in the urine and in one case methemoglobin was present. Symptoms of poisoning may be experienced when this substance is inhaled in the form of a vapor, causing muscular paralysis accompanied by convulsions.

Postmortem Appearances.—These show the lungs and other organs to be anemic, and the right side of the heart engorged with blood. When the vapor has been slowly inhaled, the brain is found congested and blood is found in both sides of the heart.

Methyl Alcohol

Methyl alcohol or wood alcohol, is formed in the destructive distillation of wood. It is a colorless, volatile liquid, burning with a pale bluish flame, miscible with water, alcohol, and ether in all proportions. It is in such general use that accidents, and even suicides, have become quite common. It is largely used in paint factories as a source of heat, and as a cheap form of alcohol for its use as a solvent. One case might be mentioned to show to what extremities people will go when they desire to get the effects of alcohol. A man diluted some shellac made from wood alcohol, drank the supernatant liquid, and died from the result. Most of the cases reported have been due to accident caused by drinking wood alcohol as a substitute for ethyl alcohol. Occasionally painters have been poisoned by its vapors. It is used in many proprietary preparations, such as cologne spirits, bay rum, etc.

The symptoms of acute poisoning by wood alcohol are similar to those observed after an excessive dose of ordinary alcohol; that is, exhilaration followed by narcosis; but the headache, nausea, and vomiting are often more violent. There are also pains extending over the region of the kidneys, an ashy color of the skin, dilated pupils, restlessness and exhaustion, and death often within twenty-four hours. Where the victim is exposed to the vapors of wood alcohol for a considerable time he may suffer from subacute poisoning which is characterized by chills and vertigo, followed by sleep and occasionally by death. In these cases, there often occurs a peculiar disturbance of vision, accompanied by dizziness. Blindness and atrophy of the optic nerves have followed the taking of 2 to 5 drams. A few cases are reported where inhalation of wood alcohol has caused blindness, but, as a rule, in this subacute form of poisoning the most marked symptoms are nausea, vomiting, and headache, followed by coma. Blindness, as a rule, soon develops; the pupils dilate and are insensible to light. As a rule, the vision is permanently affected to a greater or less extent.

The blindness which is often caused by methyl alcohol may disappear in a few days, only to return later, ultimately resulting in a permanent disability.

Treatment.—When alcohol has been swallowed, the stomach should be emptied by washing out, and stimulants, such as caffein, or strong coffee given. Hot and cold baths may be employed to combat the coma. Pilocarpin, potassium iodid and strychnin, and cathartics have been used to combat the blindness. Diuretics may be employed to assist in the elimination of the poison.

The **lethal dose** is probably greater than that of ordinary alcohol. In a series of cases that have been reported, where each of five men drank a tumbler full of wood alcohol, two recovered entirely; one lost the vision of one eye and had a partial injury in the other, and two died within twenty-four hours.

From experiments it would seem that the ingestion of wood alcohol is followed by more serious and dangerous symptoms than is the case with ordinary alcohol. It is partially oxidized in the body, where ordinary alcohol is probably more completely used up. It forms within the system, secondarily, sodium formate, which is much more poisonous than the alcohol itself, and this may account for the serious symptoms caused by poisoning by this agent.

Postmortem Appearances.—The postmortem appearances are more or less similar to those of poisoning by ordinary alcohol. One reported was as follows (Medical Examiner Titcomb, Cases 1 and 2, 1892, in the medical examiner's reports to the Massachusetts Secretary of State): "Surface of body dark colored. Heart and blood-vessels on its surface engorged with dark blood; right ventricle full of liquid blood, dark colored; left ventricle empty. Liver congested and its vessels moderately filled with dark fluid blood. Lungs congested, especially the lower lobes; pulmonic tissue firm to touch; inner walls of large bronchi covered with sero-sanguineous fluid and their mucosa deeply injected. Kidneys congested. Intestines not remarkable. Stomach, internal surface deeply injected. Spleen dark in color. Brain, vessels of dura mater full of dark-colored blood; brain substance deeply congested with numerous extravasations. No other diseased appearance in any other organ."

Detection.—Methyl alcohol can be **isolated** from the tissues as described under Ethyl Alcohol. It can often be **recognized** by its odor. Pure methyl alcohol does not give iodoform with caustic potash and iodin. Mercuric nitrate heated with ethyl alcohol is reduced to a black precipitate on adding ammonia. Methyl alcohol does not give this reaction.

AMYL NITRITE

Amyl nitrite is a colorless, volatile liquid with a peculiar odor, boiling-point 96° C., insoluble in water, soluble in ether. Warmed with alcoholic potash, amyl nitrite forms amyl alcohol and potassium nitrite.

Amyl alcohol, amyl acetate, and amyl iodid have the same effect as does the nitrite. At first there is a dilatation of the capillary blood-vessels, which is accompanied by violent action of the heart. This is soon followed by diminished heart action and capillary contraction. It is not an anesthetic and does not produce unconsciousness. When unconsciousness is produced generally death ensues. Headache and confusion of the intellect often occur, accompanied by a peculiar flush of the countenance.

If amyl nitrite has been ingested, the stomach should be washed out and the bowels emptied by cathartics. If the symptoms have been produced by its inhalation, artificial respiration and the inhalation of oxygen should be tried.

Postmortem we find the lungs and other internal organs whitened and free from blood; the right side of the heart engorged, the left empty, and the brain bloodless.

Tests.—As amyl nitrite is very volatile, care must be exercised in distilling it lest some of it be lost. On heating with potassium hydrate it is decomposed into amyl alcohol and potassium nitrite, and the presence of both can be easily confirmed by suitable tests.

ANILIN AND ITS DERIVATIVES

Anilin (amidobenzol), which is so largely used as the basis of the so-called anilin dyes which are extensively used in dyeing, has given rise to many cases of poisoning, many of which have been accidental, though a few have been suicidal. In the accidental cases, some of which have been severe, the symptoms have been caused by the wearing of articles of apparel dyed with anilin or its derivatives. In some cases there has been a question whether it was the anilin or some impurity in the anilin, such as arsenic, which may have been the cause of the symptoms. Other impurities that exist in the anilin dyes are lead, sulphuric acid, carbolic acid, and various mordants. Some of the anilin salts and their allied hydrocarbons are apparently more poisonous than the base itself.

Anilin (amidobenzol) is a colorless, inflammable oil, with a peculiar odor and aromatic taste; it is slightly soluble in water, readily so in alcohol and ether.

Acetanilid, phenacetin, exalgin, and antipyrin are among the derivatives of anilin which are so widely used in medicine as antipyretics. These derivatives are, as a rule, white, crystalline bodies, soluble in alcohol, and chloroform.

Albumen is coagulated by anilin, and the blood-corpuscles are destroyed to a certain extent by its action. This interferes with the blood's ability as an oxygen carrier to the tissues of the body. Acetani-

lid has been the cause of fatal poisoning where the indiscriminate use of so-called headache powders or tablets has been carried to excess.

The **symptoms** are excited, reflex action with increased sensitiveness of the skin, depression of the pulse and arterial distention, with first an increased body temperature, followed by its decrease. A marked symptom is cyanosis. Its action upon the kidneys is that of an irritant, so that we may have a well-marked nephritis produced. Convulsions, delirium, and coma may supervene. The use of anilin, acetanilid, and other derivatives, where these substances have been employed, often without the advice of a physician, has led to many cases of subacute and chronic poisoning. The symptoms are cyanosis, jaundice, and anemia. The action of these substances is not fully determined. There is apparently some change in the blood-corpuscles themselves, which prevents the proper oxidation of the tissues necessary to the maintenance of life. In the urine, definite chemical substances, such as salicyluric acid, have been found as the result of the administration of anilin derivatives. The idiosyncrasy of people plays an important part in the action of these substances.

The **lethal dose** is not definitely determined, but it is probably fairly large—90 gms. or so.

Treatment.—Sodium sulphate should be administered after washing out the stomach to remove any unabsorbed poison. Inhalation of oxygen may be practiced to assist the damaged blood-corpuscles in their function. In chronic cases heart stimulants, but not alcoholic ones, should be employed.

Detection.—Anilin may be distilled with steam from an alkaline mixture and, if in large quantities, separated in the distillate as an oily layer, from which it can be removed by shaking out with ether. With potassium bichromate, anilin gives first a red, then a blue color, which slowly disappears; with fuming nitric acid, a deep blue solution, becoming yellow and finally red on warming. Treated with a solution of chlorinated lime and a few drops of dilute ammonium sulphid solution, it develops a rose-red color. A pine shaving, moistened with very dilute solution of anilin salt, is colored yellow. With bromin water, tribromanilin is precipitated. The derivatives of anilin can also be removed from the material in acid solution by precipitation of the proteids with a large quantity of alcohol. The filtrate is then concentrated, the residue taken up with water if necessary, and the solution shaken up with ligroin and then with chloroform. The chloroform extracts most of these substances. After evaporation the residue can be tested for the suspected substance.

Acetanilid with potassium hydrate and chloroform gives the disagreeable odor of phenyl-isocyanid; boiled with potassium hydrate and a

drop of chlorinated lime solution and held above the mixture, it is soon colored yellow, later turning violet. Acetanilid warmed with a little hydrochloric acid and a few drops of the solution of calcium hypochlorite and phenol, a red color is produced, becoming red on the addition of ammonia.

Antipyrin gives a red color with ferric chlorid, which is discharged by mineral acids. Sodium nitrite, acidified with sulphuric acid, produces a green color.

Phenacetin heated with nitric acid yields yellow, crystalline needles. Antipyrin and acetanilid do not give this test.

BENZOL GROUP

Correctly speaking, the benzol group of poisons belongs to the class of anilin poisons which we have already considered. Benzol itself is a colorless liquid, very slightly soluble in water, soluble in alcohol, ether and acetone, having at ordinary temperatures a disagreeable odor; sp. gr. 0.86, mpt. 4.5°, bpt. 80.5°. It dissolves phosphorus, rubber, and sulphur, and almost all of the alkaloids. It is very highly combustible, burning with a luminous, smoky flame. With chlorin and bromin it forms addition and substitution products.

Nitrobenzol

Nitrobenzol, artificial oil of bitter almonds, "essence" or "oil of mirbane," is a yellow liquid, with an odor of bitter almonds, very sparingly soluble in water, easily soluble in alcohol and ether; bpt. 213° C. It is extensively used in the manufacture of anilin, of perfumes, and explosives, and as an artificial substitute for oil of bitter almonds in flavoring extracts. Accidents have occurred from the inhalation of the vapor. It has been used as a suicidal agent, also to produce abortion. The symptoms of poisoning resemble so closely those of the anilin derivatives that the reader is referred to them as well as the following.

Symptoms.—Nitrobenzol is poisonous even when swallowed in small doses or when the vapor is inhaled; the latter produces the more violent symptoms. When swallowed with alcohol the symptoms are intensified. Poisoning by this substance differs from that by cyanid in that the symptoms appear more slowly and are not so pronounced. The eyes are bright and glassy, the features pale and ghastly, the lips and nails purple, the skin clammy, and the pulse feeble. After several hours the patient becomes unconscious, muscles stiffen, and general convulsions follow.

The appearance of the symptoms varies according to the nitrobenzol that has been used. When pure, it is so sparingly soluble in water that it

will not mix with the fluids of the stomach and is absorbed slowly, and the symptoms may be delayed for some hours. If, on the other hand, the poison is taken with alcohol (in which it is easily soluble) the symptoms may come on almost immediately. Vomiting frequently occurs, the vomitus having the peculiar odor of nitrobenzol. There is often pain in the stomach and abdomen, with incontinence of urine and feces. In many cases, however, the blue color of the skin and the deep sleep are the only symptoms.

The various nitro-substitution products, if soluble, are more poisonous than nitrobenzol itself. They apparently produce a peculiar action upon the blood which can be examined by means of the spectroscope. One case is reported where a workman spilled some nitrobenzol on his clothes. He became drowsy from inhaling an atmosphere charged with the vapors; staggered in his gait, and appeared intoxicated; later becoming comatose; he died about nine hours after the first symptoms were observed.

Continual exposure to the fumes of nitrobenzol in factories commonly leads to symptoms of chronic poisoning, such as sleeplessness, increased respiration, cyanosis, and sometimes failure of the eye-sight; the urine gives off the odor of nitrobenzol, has a dark-red color, and on being shaken with chloroform, the nitrobenzol can be extracted. Under appropriate treatment, convalescence usually takes place in from ten days to two weeks. Fifteen drops of nitrobenzol have been a fatal dose, but on the other hand, with appropriate treatment, over 100 c.c. have been taken and recovered from. Death usually takes place in from six to ten hours; occasionally in much less time.

Treatment.—Washing out of the stomach and the administration of stimulants should be employed, but no alcohol. Artificial respiration and the inhalation of oxygen may be necessary in acute attacks.

Its action appears similar to that of anilin; that is, changes in the physical condition of the blood-corpuscles, whereby the metabolism of the body is interfered with and the nerve-centers controlling the heart and respiration are paralyzed. Methemoglobin may be recognized by means of the spectroscope.

Postmortem Appearances.—Occasionally, nitrobenzol is present in the stomach and intestines several days after death. There are numerous ecchymoses in the esophagus, stomach, and duodenum. The blood is fluid and dark brown and only slightly coagulated. The color of the blood is a characteristic differential symptom from poisoning by prussic acid. In the latter case the blood is usually cherry-red. The kidneys also show the effects of the irritant action of the nitrobenzol.

Isolation.—By fractional distillation, the benzol can be separated from organic mixtures, the portion boiling between 70° and 90° will

contain the benzol, and this can be purified by successive fractional distillations. It can be identified by making various substitution products.

Tests.—Essential oil of almonds and nitrobenzol give a blue color when distilled with lead acetate and chlorinated lime is added to the distillate. Nitrobenzol, on the addition of potassium hydrate, alcohol, and sulphur, gives a red color. Stannous chlorid in sodium hydrate with nitrobenzol forms anilin.

The principal tests for nitrobenzol are its peculiar odor, resembling that of bitter almonds; its insolubility in water, and the ease by which it can be converted into anilin by metallic zinc and hydrochloric acid in the presence of alcohol. Chemically, it can be easily distinguished from prussic acid with which it may be confounded in diagnosis.

Naphthalene

Naphthalene is the simplest of these substances in which two or more benzol rings are united in such a manner that each possesses two carbon atoms in common. It occurs in coal-tar; crystallizes in large shiny plates which are easily sublimed. It burns with a smoky flame, is insoluble in water, soluble in alcohol and ether. It forms substitution products with halogen and with nitric acid.

The **detection** of naphthalene is made by distilling the material with steam, when the naphthalene will be found in the distillate, from which it can be extracted by shaking with ether. Ammonium sulphid or sodium hydrate, when added in small amount to the solution containing naphthalene, produces a fluorescence. A lemon-yellow color develops on the addition of a few drops of calcium chlorid and strong hydrochloric acid to the naphthalene. This may be extracted with ether and underlaid with an aqueous solution of resorcin. The addition of ammonia develops a blue-green color which is changed to a cherry-red by nitric acid.

CAMPHOR

Camphors are various ketones and aldehyds, and others are alcohols. Ordinary camphor, Japan camphor, is a white, translucent, crystalline mass with a peculiar, pungent odor and taste; slightly soluble in water, quite soluble in methyl and ethyl alcohol, ether, chloroform, and acetic acid and the various oils.

Camphor is often used medicinally in the so-called camphor water, camphor liniment, soap liniment, spirts of camphor, paregoric, etc.

Various dangerous symptoms of poisoning have been produced by the use of camphor, although it is doubtful if any fatal case can be attributed to this agent. In those cases that have been reported, vertigo, con-

fusion of the intellect, and delirium are the most prominent symptoms. The primary action of large doses of this drug is that of a powerful but not permanent sedative of the nervous system, followed by a slight, transient febrile excitement.

Monobromated camphor, formed by combination of camphor and bromin, is a violent poison when taken in more than a dose of 30 grains. The symptoms are muscular weakness, prostration, convulsions, reduction in the temperature of the body, decreased frequency of the respiration and pulse, coma and death.

Detection.—Camphor can be readily detected by its peculiar odor and can be separated from organic mixtures by shaking with naphtha after first acidifying. The naphtha allowed to evaporate will leave the camphor behind mixed with more or less fat. This impure camphor may be repurified by crystallization from dilute alcohol, and readily recognized by its taste, odor, and melting-point.

CARBOLIC ACID

Carbolic acid has given rise to numerous cases of poisoning, both suicidal and accidental. When pure, it occurs in the form of white, colorless, needle-shaped crystals which, after standing a long time, become pinkish. It absorbs moisture readily and becomes converted into an oily liquid of a reddish or brownish color. It is soluble in 20 parts of water, very soluble in alcohol, chloroform, and ether. It absorbs water, forming a hydrate which crystallizes in prisms and is known as "95% acid." The crystals of the pure acid melt at about 40°, those of the hydrate at 16°.

Carbolic acid is easily mistaken by its smell and taste for common whisky, and most cases of poisoning are attributable to that cause and to its use as a common household disinfectant.

Carbolic acid produces severe **symptoms** when applied to the broken skin or to wounds, such as disturbances of digestion, loss of appetite, ringing in the ears, headache, and sometimes nephritis; occasionally convulsions followed by narcosis. When taken by the mouth, the acid, as is the case with other corrosive acids, produces a burning pain in the throat and stomach, and the mucous membrane of the lips, mouth, and throat become white; vomiting is not always present; difficult respiration may appear, becoming stertorous; the pupils are inert to light and contracted. When applied locally it produces a caustic and *benumbing* effect.

Death may be caused by the inhalation of the vapor of carbolic acid, and at least one such case is on record.

Severe symptoms of poisoning have occurred where carbolic acid has been locally applied on the body. In using carbolic acid as an antiseptic,

and especially in its use in abscess cavities, it has produced severe symptoms. These cases can generally be guarded against where the urine is carefully examined. When the acid is absorbed it unites with the sulphuric acid radicle in the economy to form phenol sulphuric acid which has no poisonous action upon the economy, so that as long as there is sulphuric acid with which it can unite there are no toxic symptoms in the patient. Ordinarily, if we acidify a specimen of urine with acetic acid and add a solution of barium chlorid we obtain a precipitate of barium sulphate; but if all of the sulphates have been used up by the carbolic acid, no such precipitate will occur. In such cases the ingestion of sulphates, such as sodium sulphate, may be employed to neutralize the effect of the carbolic acid.

Lethal Dose.—The fatal dose for adults is about 15 gms.

Treatment.—The treatment should be directed first to the removal of the contents of the stomach and to check its local action upon the mucous membrane of the mouth and throat. Sodium sulphate is a true chemical antidote, as mentioned above. External heat should be applied to the surface of the body.

Postmortem Appearances.—The postmortem appearances are similar to those of other corrosive and irritant poisons; peculiar white streaks and shriveled skin are very marked. The mucous membrane of the mouth is reddened, often edematous and swollen, sometimes whitened by the caustic action.

Detection.—Carbolic acid can be recognized by the following tests: its peculiar odor; its coagulation of albumen; a pine splinter soaked in an aqueous solution of carbolic acid becomes blue when moistened with strong hydrochloric acid. An aqueous solution when treated with ferric chlorid or sulphate gives a violet or beautiful blue color. Bromin water precipitates it in the form of tribromphenol, yellowish-white. Millon's reagent produces a beautiful red color which is one of the most delicate of the tests.

Carbolic acid can be isolated from the urine or other fluids by distillation after previously acidifying with sulphuric or phosphoric acid. The tissues must be finely divided and extracted with very dilute acid; this extract evaporated and the resulting fluid distilled.

CARBON DISULPHID

Carbon disulphid is a colorless liquid with a peculiar odor; bpt. 47°, very volatile, immiscible in water, soluble in alcohol and ether; it is very combustible, burning with a blue flame, and yielding carbon dioxid and sulphur dioxid. It readily dissolves sulphur, phosphorus, fats, and rubber.

There are a few cases of fatal poisoning by this substance. The

POISONING BY CARBOLIC ACID.

Death after one hour. Eschars on the gastric mucosa.

symptoms were pallor of the face, dilated pupils, frequent and weak pulse, convulsions, and death within three hours. Inhalation of the vapor of carbon disulphid causes headache, dizziness, vomiting, and coma.

In factories where carbon disulphid is used in large quantities, such as rubber factories, chronic poisoning frequently occurs. The symptoms of chronic poisoning are a primary stage of excitement, with headache and disturbance of the digestion, such as loss of appetite and nausea; sensitiveness of the skin is also increased, with creeping sensation, numbness and pain, ringing in the ears and noises in the head. Sleep is disturbed by dreams and pain in the limbs is a constant symptom, with spasmodic contraction of the muscles, and later there is a stage of depression. The patient feels as if the tongue were covered with cloth. Paralysis of the legs also occurs.

Treatment.—Stimulants and warmth to counteract the collapse, artificial respiration, and the use of oxygen, if necessary, is the appropriate treatment.

Postmortem appearances are not characteristic.

Detection.—Mixtures containing carbon disulphid may be extracted with alcohol and the filtrate evaporated, when the carbon disulphid will be perceived by its peculiar odor. Iodin gives a violet-red color when dissolved in carbon disulphid.

CHLORAL HYDRATE

Chloral hydrate, $CCl_3.COH.H_2O$, commonly called chloral, and improperly so, is a white, crystalline compound formed when chloral is mixed with water. It is easily soluble in water, alcohol, and ether; has a peculiar odor and disagreeable taste. It is easily decomposed by alkalies into chloroform, formates, and water.

Most of the cases of poisoning by this drug have been due to negligence or accident, a few to suicide, and very rarely to homicide.

The **symptoms** vary in different persons and under different circumstances. To a healthy subject not addicted to alcohol there is at first a period of excitement, which is immediately followed by a tendency to sleep. The effect of a single moderate dose can generally be warded off by the will, but repeated doses or a single large dose produce narcosis. The body temperature is generally reduced immediately after taking the dose. During the narcosis the face is flushed, and in fatal cases, where too much of the drug has been given, this sleep may pass directly into death. Occasionally there is collapse and the patient dies in syncope.

The continual use of chloral causes disturbances in the digestive tract, which may be complicated with diarrhea, and may later result in emaciation. The first danger signal from the poison of this drug is a

peculiar rash similar to that of scarlatina. This may be followed by desquamation, and is generally accompanied by albuminuria. There is also seen a purplish color at the roots of the nails. With impaired nutrition there are various nervous symptoms, such as sleeplessness, befogged intelligence, and sometimes melancholia.

English physicians consider 50 grains a full dose for adults. Children, as a rule, bear proportionately larger doses better than adults, and old persons are more susceptible to the action of small doses.

Treatment.—Strychnin has been used by Liebreich as an antidote for chloral, but this has been questioned. The most reasonable treatment is external stimulation or rectal injection, if necessary, of some stimulating liquid, the use of electricity, and placing the patient in a warm atmosphere.

The absorption is so rapid that washing out of the stomach is apparently not of much use. Artificial respiration should be tried, also, if necessary, the inhalation of oxygen. Caffein or hot coffee may be used as a heart stimulant if the patient can swallow it.

The action of chloral hydrate is probably that of inhibition of the nerve-center controlling the heart's action, and for the same reason respiration is slow and finally ceases.

Postmortem Appearances.—The blood-vessels of the membranes of the brain are congested, the sinuses contain clotted blood, and the brain appears somewhat shrunken, but no unusual number of hemorrhagic spots are noticed; the esophagus is usually reddened and thickened, and its mucous membrane softened; the right heart is engorged and the left empty; the blood in the heart may be partly clotted and partly fluid; the spleen, liver, etc., are filled with dark blood; fatty degeneration and infiltration of the kidneys are often seen.

Its **detection** will be taken up under Chloroform.

CHLOROFORM

Chloroform is a heavy, non-inflammable, colorless liquid, volatile at ordinary temperatures, bpt. 61° C. It has a peculiar sweetish taste, neutral reaction, and a characteristic odor; is slightly soluble in water, miscible in alcohol and ether in all proportions. It is frequently contaminated with alcohol, chlorin, and other impurities.

Most of the cases of poisoning by this agent are accidental, due to the inhalation of too much of its vapor; rarely is it used for suicidal purposes, and there is one homicidal case on record.

Taken internally, chloroform causes symptoms in a short time, which are very similar to alcoholic intoxication. Later there are serious symptoms of insensibility, stertorous respiration, convulsions, and finally death in a few hours. If the patient recovers consciousness, pain in the

esophagus and stomach persist, often accompanied by jaundice and catarrhal bronchitis.

Where the ingestion of chloroform has not been attended with immediate fatal results, the patient may be in a comatose condition for many hours, and later recover consciousness, suffering from abdominal pain, bloody diarrhea, jaundice,and painful micturition. If the primary irritation is due to most of the chloroform passing into the stomach, he may die from gastritis or enteritis or from failure of the heart's action. If the condition was caused by the inhalation of chloroform fumes, death will ensue from pulmonary disturbances or from failure of the heart's action.

Anesthesia produced by chloroform is similar to that caused by ether. There is usually at first slight cough, with expectoration of mucus, increase in the salivary flow, and labored respiration. Later, inspiration becomes strong and deep and the pulse quickened. With these symptoms there are often irregular movements of the limbs. With further inhalation of the fumes, the face becomes flushed, the eyes brilliant and soon laughter and incoherent expressions may be heard; the pulse slows down and general insensibility with muscular relaxation ensues. This is the period of surgical anesthesia. If the drug be pushed, the respiration becomes stertorous, the pulse slow and weak, and death takes place from asphyxia. Occasionally death takes place without any warning symptoms.

The use of chloroform to render persons insensible in order to commit robbery or other crimes is one that is often dreaded by the laity, but this is probably a mistaken opinion.

Detection.—If organic mixtures are to be tested for chloroform, investigation should be undertaken as soon as possible, lest this volatile agent disappear and escape detection. The material for investigation, in a finely divided state, is placed in a retort and slightly warmed. The vapor of chloroform distilled over is passed through a red-hot porcelain tube into a tube containing silver nitrate, slightly acidified with nitric acid; if chloroform be present, a white flocculent precipitate of silver chlorid will be formed, and fumes will be seen issuing from the exit of the tube. These fumes can be identified as chlorin gas by holding near them a piece of moistened blue litmus, which will first become red and finally bleached. Care should be taken that the vapor passes through the combustion tube slowly. The white precipitate in the tube containing silver nitrate may be easily identified as silver chlorid, as it is soluble in ammonia, insoluble in nitric acid. Any free hydochloric acid in the tissues must first be neutralized by sodium or postassium hydrate. If chloral has been taken by the patient and sodium or potassium hydrate added to the tissue, the chloral will become decomposed into chloroform.

Hydrochloric acid, chloroform and chloral hydrate may be tested for by the same process and apparatus and at the same time. Air may be forced through the mixture in the retort before the combustion tube is heated when, if free hydrochloric acid is present, it will produce a precipitate of silver chlorid; if no precipitate appears in a few minutes then the tube may be heated, when, if chloroform is present, silver nitrate will be precipitated. If no result ensues, then sodium hydrate may be added to the contents of the retort and the porcelain tube again heated, when, if chloral is present, silver chlorid will be precipitated in the tube and chlorin will be seen at the exit.

Chloroform heated with a few drops of a moderate dilute solution of resorcin and a few drops of sodium hydrate becomes reddish-yellow with a yellowish-green fluorescence. Beta-naphthol in a small quantity of potassium hydrate solution added to a portion of the suspected liquid produces a blue color if chloroform is present. Anilin and alcoholic hydrate of potassium warmed with chloroform gives phenylisocyanid which may be recognized by its odor.

CROTON OIL

Croton oil is a fixed oil expressed from the seeds of *Croton tiglium*. It is a yellowish, somewhat viscid, fluorescent liquid, with a mild, oily taste, which later becomes burning. It owes its peculiar action to the principle called crotonan. When applied to the skin it produces a pustular eruption, and when taken internally is a drastic cathartic. It is soluble in alcohol, ether, chloroform, and the fixed and volatile oils, and has an acid reaction to litmus paper.

Fig. 7.—Croton tiglium. (Croton oil.)

When croton oil is taken internally, it produces intense burning and irritation of the mouth and throat, profuse salivation and vomiting; later there is severe pain in the epigastrium and profuse diarrhea, the discharges sometimes being bloody. The surface of the body is covered with a cold sweat, the pulse becomes small and irregular, the respiration is slow, and a diminution in the body temperature and cyanosis may follow; finally delirium, collapse, and death from gradual cessation of respiratory function.

Rancid specimens of croton oil have a stronger action than fresh samples. As croton oil is a strong emetic, it is impossible to give a minimum lethal dose. Its action on an empty stomach is, of course, much more severe than on a full one. One or two drops have been followed by severe symptoms of poisoning, and 20 drops have caused death. On the other hand, recovery has occurred after a dose of 60 drops, and even after an ounce.

Treatment.—Emptying the stomach should be the first thing tried, after which soothing drinks should be given and stimulation if necessary.

Postmortem Appearances.—We find the lining membrane of the gastro-intestinal tract swollen and reddened; hemorrhagic spots are found in the intestines, and there may be more or less inflammation.

Detection.—Organic mixtures may be acidified with tartaric acid and extracted with ether, filtered, the filtrate evaporated, when the croton oil together with other fatty substances will be found in the residue. This residue may be rubbed upon the surface of the arm, observing any eruption that may occur, and a small portion may be administered to a cat or dog and the cathartic effect noticed. There are no special chemical tests that can be used, on account of the small amount that is usually present in the tissues.

DIGITALIS

Digitalis purpurea, or the common foxglove, contains three bodies which exert a characteristic action upon the heart, called digitalin, digitalein, and digitoxin. These are accompanied by various products of decomposition. The action of digitalis is more or less the action of all of these substances. In crude preparation the solution of these bodies is doubtless increased by the presence of saponin substances.

FIG. 8.—DIGITALIS PURPUREA. (Purple fox-glove.)

Digitalin is readily soluble in water and alcohol, while the other two dissolve only in boiling alcohol. These three substances are broken up into two active products, called "digitali-resin" and digitoxi-resin," neither of which has any action on the heart, according to Kobert. Badly dried digitalis leaves and their infusion may be decomposed by bacteria, with the formation of substances which may produce violent symptoms. Digitalin may be obtained in crystalline form, but it is

usually formed in spherical masses. It is difficultly soluble in boiling water, readily soluble in alcohol and a mixture of alcohol and chloroform; slightly soluble in ether, chloroform, and benzol. Hydrochloric acid colors it yellowish-green; sulphuric acid, greenish-brown, which changes to a beautiful violet-red color if exposed to the action of bromin vapor.

Digitalein is soluble in all proportions of water, readily soluble in alcohol and ether, insoluble in benzol, slightly soluble in chloroform. Concentrated hydrochloric acid produces a light yellow color; sulphuric acid produces a red color which changes to a violet when treated with bromin, and then to a green if diluted with water. The most important test for digitalein is the physiological one, which is best performed with frogs, as the heart can be exposed. Very small amounts suffice to reduce the frequency of the heart's action, finally stopping it in systole.

The **symptoms** produced by digitalis have certain differences by which they may be distinguished from those caused by other heart poisons. They are characterized by a peculiar property of slowing the pulse. Digitalis can properly be called one of the cumulative poisons. Often when the poisonous action is delayed for some time, marked symptoms may suddenly appear, even producing death. It is not definitely known to what this peculiar action is due; it may be that it acts upon the nerve-center controlling the action of the heart.

One case is reported in which the symptoms were nausea which increased until the vomiting became violent and frequent. There was great precordial distress, intense frontal headache, ringing in the ears, and very powerful but, at the same time, irregular and intermittent pulsations of the heart, with diminished frequency; sighing respiration, severe thirst, retention of urine, and great debility. Digitalis also produces great irritation in the stomach, disturbances of sight and sometimes vertigo. Occasionally also there is diarrhea of glairy liquids of a greenish color.

Chronic poisoning by digitalis follows the continued administration of small medicinal doses, and often, though the medicine may be tolerated for a long period, even weeks, violent symptoms may suddenly appear with syncope and acute frontal headache. One author states that two-thirds of the cases of acute poisoning are recovered from, even where there are very severe symptoms. The action upon the heart, in reducing the number of pulsations a minute, is a very general symptom and may persist even after leaving off the medicinal dose.

The cumulative form of poisoning is marked by the sudden appearance of the above symptoms, and occasionally even paralysis of one side of the body may occur. These symptoms may produce death without warning. Occasionally these symptoms are varied, and the shock to the

nervous system is more pronounced than the disturbance of digestion; hallucinations are often experienced; chills, chattering of the teeth, and cold perspiration; also irregularity of breathing, bulging of the eyeballs, accompanied by thirst, general feebleness, absence of diarrhea and retention of urine.

The **lethal dose** of digitalis poisoning is indefinite. One ounce of the tincture has been recovered from. On the other hand, about 35 grains of the powdered leaves have caused death. Where there is a previous heart lesion or disturbance in the nervous system controlling the heart's action, smaller doses may produce severe or even fatal symptoms.

The various active principles in commercial use do not all possess the power to produce similar symptoms.

The retardation of the heart's action is attributed to the stimulation of the inhibitory nerves, and the frequency of the pulse is probably due to their paralysis. In addition to these direct actions upon the inhibitory nerve-centers and upon the heart ganglia, there is also the action of digitalis upon the vasomotor nerves which produce contraction of the arteries and blood-pressure right after section of the spinal cord. The surface temperature of the body is often increased, but internally it is lowered.

The **diagnosis** of digitalis poisoning is easily made from the peculiar action upon the heart and circulation, especially when there are also disturbances in the digestive tract.

Postmortem Appearances.—These are not particularly characteristic; the right side of the heart is usually found filled with blood and the left side usually empty. The brain and its membranes may be anemic; the stomach and mucous membrane of the intestines more or less ecchymosed, with here and there patches of injection. In many cases of digitalis poisoning there may be no pathological changes other than more or less reddening of the intestinal mucous membrane.

Detection.—Where the plant itself has been ingested, portions of it can often be found by careful search in the vomitus and feces, and in the contents of the stomach and intestines. In such cases the vomitus and feces usually have a bright green color due to the coloring matter of the plant. This green color can be distinguished from that caused by the copper compounds by its not being changed blue on the addition of ammonia, and from bile by its not giving the characteristic color tests with strong nitric acid. The upper surface of the full-grown leaf is green, but pale and more or less silvery on the younger leaves, and contains very short, transparent hairs which have a very brilliant and crystalline appearance; the under surface of the leaf is pale and contains a much larger number of brilliant hairs than does the upper surface. The leaves also have another kind of vegetable hair which is jointed, not

crystalline and usually made up of two or three segments. Both of these varieties may easily be detected by microscopic examination of the leaf, the contents of the stomach, vomitus, etc., when the powder, decoction, or infusion has been taken, except when the last two preparations have been very carefully strained, which is usually not the case.

Digitalein can be **isolated** from organic mixtures by the process recommended for opium alkaloids (see page 354). The digitalin is separated by benzol from the acid fluid, and digitalein by chloroform, and are left as residues after the evaporation of these fluids.

The chloroform residue dissolves in concentrated sulphuric acid with a green color, which on the addition of bromin water turns purple-red, and on diluting with water, green. When mixed with equal parts of concentrated sulphuric acid and alcohol and heated, it turns yellow, and later assumes a blue-green color on the addition of dilute ferric chlorid. Phosphomolybdic acid develops a green color, which is changed to blue by ammonia.

DRASTIC PURGATIVES

The drastic purgatives include jalap, scammony, gamboge, colocynth, croton oil, and elaterium. Only the last two are used by themselves to any extent in medicine, but are generally combined with other drugs. They are usually ingredients of many cathartic medicines, and have caused death from exhaustion arising from excessive purging. It must be borne in mind that the very young as well as the aged cannot bear violent purgatives as well as those in the middle period of life.

They are all irritants and exert their action upon the intestinal canal.

Symptoms.—Dangerous symptoms of overdoses of these substances are in most cases vomiting, pain in the epigastrium, violent purging, and collapse. Children have been severely poisoned by drinking the milk of cows that were fed upon mandrake. There may also be a slow and weak pulse and difficulty in speech. The urine may be smoky and show evidence of renal irritation.

Treatment.—The treatment of all of these purgative poisons is similar to that mentioned under Croton Oil; that is, the poison should be removed by emetics, or the stomach-pump, and soothing drinks afterward administered. A careful diet should be prescribed and cardiac stimulants may be given if necessary.

Postmortem appearances are those of gastro-intestinal irritation, and there may be ulceration and inflammation of the kidneys and bladder.

ERGOT

Ergot occurs as a parasitic fungus which grows on rye and occasionally on other kinds of grain. It is interesting, toxicologically, as it has

given rise to epidemics of poisoning on account of the bread and meal containing it. If a healthy grain of rye be examined by the microscope it will be seen to be composed of the seed covering, consisting of two layers, beneath which are the gluten cells, while the larger part of the seed is composed of cells containing starch. This seed covering and the gluten cells may be replaced by dark cells, while the large starch cells are filled with the small cells of the fungus and drops of oil. This causes the so-called smutty, or ergotized, grain.

Symptoms of poisoning by this agent are of two kinds. The specific action is recognized by the contraction of the involuntary muscles. The other, that of the so-called chronic poisoning or "ergotism" which will be described later, is marked by the appearance of gangrene. The ACUTE SYMPTOMS are generally vomiting of blood, passing of bloody urine, intense jaundice, and stupor. Where the jaundice and vomiting are lacking, intense gastro-intestinal irritation is experienced, accompanied by pains and diarrhea, and in the subacute form we have disturbances of the nervous system, such as weakness of the limbs, disturbance of vision, retention of the urine, delirium, coma, and death.

FIG. 9.—ERGOT OF RYE.
1, ear of rye with ergot (spurred rye); 2, the ergot; 3, diseased grains of rye.

In CHRONIC POISONING, "ergotism" caused by eating ergotized cereals, we have more marked disturbances of the nerve-centers, giddiness, noises in the ears, loss of sensation in the toes and fingers, often in the tongue, diarrhea, vomiting, colic, and other symptoms of digestive irritation. There may be also muscular tetany, epilepsy, and eruptions, or even boils. Death generally occurs from exhaustion. There is another form of ergotism which is marked by acute pain in the limbs, accompanied by gangrene. This gangrene is usually dry, though it may be moist. Below the healthy tissue, when the gangrene is upon an extremity, there are many moist places of ulceration, and in this way toes, fingers, legs, and even the nose may slough off.

Small repeated doses continued over a long time are more apt to produce fatal results than a large dose.

Treatment.—The treatment should be directed to the emptying of the stomach and bowels by the stomach-pump and castor oil. Stimulation may be necessary to combat the collapse. Cardiac stimulants may also be necessary.

The **postmortem appearances** in case of death by ergot show rapid

putrefaction of the tissues and a swollen condition of the mucous membrane of the intestines; the intestinal villi are seen microscopically to contain large numbers of micro-organisms.

The isolation of ergot from organic mixtures and its identification are very unsatisfactory as none of its active constituents can be definitely determined.

There are several bodies, glucosids probably, that exist in ergot, but they have not been isolated definitely as yet.

FORMIC ACID

Formic acid is rarely the cause of symptoms of poisoning. It occurs in the blood, urine, bile, and perspiration of man, in the leaves of pine trees and in the acid secretion of red ants. It is produced in a number of organic reactions by oxidation, and in fermentation of diabetic urine. It acts as a reducing agent with salts of silver and mercury. The symptoms resemble those caused by acetic acid—vomiting, abdominal pain, convulsions and paralysis, dizziness, and weakness of the heart's action. It also produces an alteration in the alkaline reaction of the blood and changes the color to a bright red. It is eliminated by the kidneys, the urine becoming a reddish-brown.

Formaldehyd, the most common derivative of formic acid, is used in medicine in an aqueous solution called "formalin." It is very irritating to the mucous membrane of the nose and throat and often causes conjunctivitis.

Formaldehyd has rarely been the cause of fatal poisoning, although the respiration of its fumes may cause severe irritation.

HYDROCYANIC ACID

Occurrence.—Hydrocyanic acid is obtained from many vegetable substances, especially those belonging to the order *Amygdaleæ* and *Pomeæ*, as from bitter almonds, apple seeds, peach kernels, apricots, cherries, plums, cherry laurel, the bark of the wild cherry, etc. The acid itself does not exist ready formed in these plants, but is a product of the reaction of the ferment emulsin upon amygdalin in the presence of water. Therefore, if any of the above substances are found in the stomach, the question may be asked whether the presence of the prussic acid is due to the decomposition of the above substances or to the acid swallowed as such. To settle this question, chemical analysis will show a larger quantity of the acid than these substances could yield, if the poisoning is due to administration of prussic acid. It is very improbable that a fatal result could ensue from the ingestion of any of these substances unless they were taken in exceedingly large quantity.

"The following plants, with many others, all yield, by appropriate

treatment, more or less prussic acid: bitter almonds (Amygdalus communis); the Amygdalus persica; the cherry laurel (Prunus laurocerasus); the kernels of the plum (Prunus domestica); the bark, leaves, flowers, and fruit of the wild service tree (Prunus padus); the kernels of the common cherry and apple; the leaves of the Prunus capricida; the bark of the Prunus virginiana; the flowers and kernel of the Prunus spinosa; the leaves of the Cerasus acida; the bark and almost all parts of the Sorbus aucuparia, S. hybrida, and S. torminalis; the young twigs of the Crataegus oxyacantha, the leaves and partly, also, the flowers of the shrubby Spiræcæ, such as Spiræa aruncus, S. sorbifolia, and S. japonica, together with the roots of the sweet and bitter cassava.

"In only a few of these, however, has the exact amount of either prussic acid or amygdalin been determined; 1 gram of bitter almond pulp is about equal to 2½ milligrams of anhydrous prussic acid. The kernels from the stones of the cherry, according to Geiseler, yield 3% of amygdalin; therefore, 1 gram equals 1.7 milligrams of (HCN) anhydrous acid.

FIG. 10.—AMYGDALUS COMMUNIS. (Bitter almonds.)

"The wild service tree (Prunus padus) and the cherry laurel (Prunus laurocerasus) contain not amygdalin, but a compound of amygdalin with amygdalic acid; to this has been given the name of laurocerasin. It was formerly known as amorphous amygdalin; its formula is $C_{40}H_{55}NO_{24}$; 933 parts are equivalent to 27 of hydric cyanid; that is, 100 parts equal to 2.89 hydric cyanid.

"In the bark of the service tree, Lehmann found 0.7 per cent. of laurocerasin (=0.02 HCN) and in the leaves of the cherry laurel 1.38 per cent. (=0.39 HCN).

"Francis, in a research on the prussic acid in cassava root, gives as the mean in the sweet cassava 0.0168 per cent., in the bitter cassava, 0.0275 per cent.; the maximum in each being, respectively, 0.0238 per cent. and 0.0442 per cent. The bitter fresh cassava root has long been known as a very dangerous poison; but the sweet has hitherto been considered harmless, although it is evident that it also contains a considerable quantity of prussic acid.

"The kernels of the peach contain about 2.85 per cent. amygdalin (= 0.17 HCN); those of the plum 0.96 per cent. (= 0.056 HCN), and apple pips, 0.6 per cent. (=0.035 HCN).

"It is of great practical value to know, even approximately, the quantity of prussic acid contained in the various fruits, since it has been adopted as a defense in criminal cases that the deceased was poisoned by prussic acid developed in substances eaten." (Blyth.)

The oil of bitter almonds, which is the product of the distillation of crushed almonds with water, contains a large amount of prussic acid. It has been estimated that 2500 parts of almond pulp contain 100 parts of amygdalin, and on distillation yield 41 parts of the oil, which contains, when fresh, 6 parts of anhydrous prussic acid. On account of the volatile nature of the acid it escapes very rapidly from the oil when the latter is exposed to the air, and preparations containing it are therefore of very variable strength. Therefore, a dangerous dose may be administered from the fact of the uncertainty of the amount contained in the preparation. Cooking, as it involves the use of heat, probably volatilizes a large part of the prussic acid, and hence there is a freedom from its poisonous action; but when the oil is used without heat, great care must be exercised. The peculiar odor is probably due to ethereal compounds.

The oil may be purified from prussic acid by shaking with potassium hydrate or, better, with some salt of iron, and distilling. Experiments have shown that when no trace of prussic acid could be detected by the iron test, the oil was not poisonous. The oil of bitter almonds can thus be freed from prussic acid, and ordinary caution would seem to demand that the oil used so extensively in cooking, etc., should be so treated, and not used freely and incautiously as at present.

The medicinal solution of hydrocyanic acid contains 2% of the anhydrous acid. Scheele's solution contains 5% or less of the anhydrous form. The various salts of hydrocyanic acid, such as potassium, silver, gold, mercury, etc., are all considered to possess the poisonous quality of the acid which they contain.

Symptoms.—The suddenness with which this agent acts upon the human system hardly allows of the observation of the symptoms. Where unconsciousness is not immediately produced, there is often faintness, loss of muscular power, and sometimes convulsions. In certain cases the patient is found unconscious, and it is impossible to know the previous symptoms; when seen in such a case, the eyes are fixed and glistening, the pupils dilated and insensible to light; the skin is cold and clammy; there is convulsive respiration at long intervals; the pulse is imperceptible, and occasionally involuntary evacuations occur (Taylor). Death usually occurs in a few minutes, but where life has been prolonged for an hour, recovery usually takes place.

Although the symptoms begin in the act of swallowing, they may not be perceived for a minute or two. When absorption takes place by inha-

lation, the symptoms may come on at a later period. As a rule, the appearance of the symptoms depends upon the amount taken, and also upon whether the stomach was full or empty. The most marked symptom is the peculiar respiration; inspiration is markedly shortened, whereas the expiration is prolonged and forcible. On account of the very rapid appearance of these poisonous symptoms, the question arises whether the death was suicidal or homicidal. One case is reported where the victim retained consciousness for a short time, as proved by circumstantial evidence. The vial containing the acid was found beneath the mattress with the cork pushed in. "The evidence adduced proved, as far as could be proved, that she swallowed an ounce of the acid, recorked the vial, thrust it to full arm's length between the feather bed and the mattress, got into bed, and then drew the clothes over her body, and there appeared to have been no convulsions."[1]

Another case is reported where a man swallowed about 7 drams of the medicinal acid. After taking the poison he walked from the table in the middle of the room to the door, unlocked it, called for assistance, and then returned to a sofa in the room and stretched himself upon it. Here he was found lying as if in a profound slumber; his legs crossed, his arms by his side, and his eye-lids firmly closed. The eyes were more brilliant than during life and continued so until the next day. His face was livid, the lips blue; the muscles were all relaxed.[2]

Still another case is that of a young man who swallowed a dose equivalent to 2.54 grains of anhydrous acid. He then descended thirty steps and walked about twenty paces before he became powerless. He was endeavoring to open the front door of the house to go out, when he suddenly fell. The only symptoms observed by a person present were that "he threw his arms about and made a noise in breathing, fetching it hard; he very soon became still."[3]

Another case is reported by Mr. Godfrey: A gentleman, aged forty-four, swallowed, it was supposed, half an ounce of prussic acid (strength not stated), but certainly a quantity sufficient to destroy life. After taking it from the bottle he walked ten paces to the top of a flight of steps, descended the stairs, seventeen in number, and went to a druggist's shop at forty paces' distance, where he had previously bought the poison, entered the shop, and said, in his usual tone of voice, "I want some more of that prussic acid." He then became insensible and died in from five to ten minutes after taking the poison.

Many more such cases might be quoted to prove the untenable nature of the statement that voluntary acts cannot be attributed to the

[1] *Boston Med. and Surg. Jour.*, Vol. XXXII.
[2] *Ibid.*, Vol. XXXVII.
[3] Lowe. *Guy's Hosp. Rep.*, 1846.

deceased after the poison has been swallowed. Another popular notion is that death is always preceded by a shriek. There are no cases which confirm such a statement, and in most cases there is neither general convulsions nor any cry, but death comes quietly and without a struggle on the part of the victim.

The SYMPTOMS OF CHRONIC POISONING by this agent may occur professionally. They are headache, dizziness, troubled respiration, pain over the region of the heart, nausea, obstinate constipation, and a full pulse.

The action of prussic acid in small, repeated doses, causes slowing of the heart's action, a prolonged diastolic period which may result in the complete arrest of the heart's action. The very rapid action of this drug is due to the direct intoxication of the blood. It forms a stable combination with hemoglobin of the blood, called cyanmethemoglobin, which has a bright red color. The formation of this compound prevents the blood from exercising its normal function of oxidation and metabolism, producing difficult respiration, weakness of the heart's action, suspension of the cerebral functions, and stasis of the circulation of the smaller vessels, and an engorgement of the right side of the heart with blood.

The **diagnosis** of poisoning by hydrocyanic acid is generally not difficult, as the fatal termination results so quickly, but there are a few other poisons which may produce a quick death, such as oxalic acid. The symptoms exhibited, the peculiar respiratory movements, the rigidity of the muscles of the jaw, would also help; and the odor of prussic acid vapor may also be observed, though, of course, this may be covered up by some other substance having a strong odor.

Treatment.—The rapid action of this drug is a hindrance to the treatment. Artificial respiration should be attempted, and, if possible, ether should be given, either by inhalation or by subcutaneous injection. Oxygen should be inhaled if possible. Ferrous sulphate in solution may be given to precipitate the unabsorbed poison, and the stomach should be immediately washed out. This is especially to be recommended when the cyanid salts, such as potassium cyanid, have been taken, and, with the ferrous sulphate, freshly prepared iron hydrate should be given. Krohl, in his experiments on cats and dogs, found that hydrogen peroxid was apparently an antidote for hydrocyanic acid.

Lethal Dose.—The fatal dose of prussic acid depends upon the strength of the solution used. Probably the commercial or even the medicinal preparations contain much less than the required 2% of the anhydrous acid, and 30 minims of the dilute acid (Br. P. solution) has caused a fatal result. Recovery has taken place after a dose of 4 drams of this same acid where the stomach was emptied, washed out,

and energetic treatment pursued. Hydrocyanic acid has proved fatal in from two minutes to one hour.

Poisoning by Substances Containing Hydrocyanic Acid.—The oil of bitter almonds has been the cause of several deaths, mostly accidental. A boy of fifteen ate a number of bitter almonds with sugar. After a time he felt a pleasing sensation, then became suddenly giddy, fell down, and lost his consciousness and recollection. Ammonia and potassium carbonate were administered, and the stomach-pump employed. Emetics were then given and in a short time he threw off most of the bitter almonds.

A druggist swallowed one-half ounce of "almond flavor". He fell insensible in less than one-half minute. There was a temporary remission of the symptoms. He was sensible for a few minutes and spoke of the nature of his attack, gradually relapsed into a delirious and apparently happy state; his eyes were brilliant, but his pulse was quick and intermittent, and his body cold. He gradually recovered from the effects of the drug.

Apricot kernels have caused death by accidental poisoning. Peach kernels caused the following symptoms in a child of three years. He was seized suddenly, and when seen was found insensible, with slow, deep, sobbing respiration; no convulsions of the limbs, but there was slight twitching of the mouth; the finger-nails were livid, the hands tightly clenched, the eyes prominent and the pupils dilated. A strong odor of prussic acid was noticed about the mouth. An emetic brought up a quantity of peach kernels, emitting the characteristic odor of hydrocyanic acid. Another case is reported where the kernels of the cherry proved fatal to a child of five years.

Postmortem Appearances.—The postmortem appearances of poisoning by prussic acid are not very characteristic; they simulate those found in death from suffocation and asphyxia. The face is pale or livid, the lips and nails bluish, and the skin of the neck, back, and shoulders much discolored. The jaws are tightly shut, the muscles of the hands and feet contracted, and rigor mortis comes in earlier than usual. The eyes have a peculiar glistening appearance, with widely dilated pupils; there may be also evidence of involuntary micturition and defecation. The heart is usually found with the right side engorged with blood; the mucous membrane of the stomach is highly reddened, and the organ often contains chocolate-colored fluid; the blood is generally dark and often purplish. The odor of hydrocyanic acid is very apparent if the autopsy is performed soon after death, but as it is more or less volatile, it does not last for any length of time.

Poisonous Cyanids.—Potassium cyanid may be taken as the type of the poisonous salts of this acid. The action is that of the cyanid

radicle rather than of the base. The local action on the stomach may be that of an irritant on account of the base present. The symptoms are similar to those produced by prussic acid, also the postmortem appearances. The odor is less noticeable; the contents of the stomach are generally acid in reaction, due to the decomposition of the salt by weak acids.

Properties.—Hydrocyanic acid itself is a transparent, colorless, volatile liquid, with a pungent taste which can be easily concealed in various drinks. It has a peculiar odor similar to that of bitter almonds or the kernels of peach stones.

Potassium cyanid is a white, amorphous body, soluble in water, with an odor of prussic acid, but odorless when pure; insoluble in alcohol.

Oil of bitter almonds contains about four times as much prussic acid as the U. S. P. solution. It has a yellow color, with a bitter, burning taste, and is slightly soluble in water. The various almond flavors and extracts used in cooking are solutions of the oil in dilute alcohol, and may prove dangerous when used by ignorant persons. Ordinarily, one ounce of the almond flavor contains a sufficient quantity of prussic acid to produce fatal results if the flavoring extract has not been purified.

Tests.—Hydrocyanic acid treated with potassium hydrate, and a mixture of ferrous and ferric salts, gently warmed and acidified with hydrochloric acid, produces a blue color called prussian blue which may be heavy enough to appear as a precipitate. With a small amount of prussic acid the liquid is colored greenish-blue and the precipitate does not appear except on standing for some time.

When prussic acid is rendered alkaline with potassium or sodium hydrate and a few drops of yellow ammonium sulphid added and the whole evaporated to dryness, the residue then taken up with water and a few drops of ferric chlorid solution added, a red color is produced due to the formation of ferric sulphocyanate. Silver nitrate, acidified with nitric acid, deposits silver cyanid, which on boiling is dissolved. If silver chlorid is present, this is not dissolved, but both the cyanid and nitrate of silver are soluble in ammonia.

The odor is so peculiar and characteristic of these substances that it cannot be easily mistaken except for nitrobenzol or the oil of bitter almonds. It has not always been detected, even when prussic acid was the cause of death. In opening the chest the odor is more plainly perceived than in any other part of the body, and the fluid in the stomach smells usually very strongly.

Detection.—If the detection is not made soon after death, there is liability of overlooking it, for prussic acid undergoes decomposition

POISONING BY POTASSIUM CYANID.

Death after ten minutes. Hyperæmia and contraction of the gastric mucosa.

very rapidly. On the other hand, a case has been reported where it has been detected twenty-three days after death.

In another case hydrocyanic acid remained in the stomach three weeks after burial and was then isolated and its presence confirmed. Its isolation is best done by distillation, but the prussian-blue test, as well as the sulphocyanate and silver tests, should be performed first by placing an inverted watch glass containing a drop or two of the proper reagent over the mouth of the jar which contains the material to be examined. Potassium ferrocyanid, ferric cyanid and sulphocyanate should be tested for before the distillation is attempted. The distillation is accomplished by placing the material in a retort, mixed with water if necessary, and distilling through a condenser, the tube of which ends in a flask. If the material is not acid it should be made so by tartaric acid. The temperature should not rise above 100° to 105° C. The first few cubic centimeters should be collected in a flask, and then another flask connected with the condenser. If prussic acid is present in the material, its odor can generally be perceived in this first distillate. In the second distillate the above tests may be made, and the presence of hydrocyanic acid confirmed. The distillation should be continued until the distillate gives no turbidity with a solution of silver nitrate, and it is better to change the flask in which the distillate is collected every little while, collecting only a few cubic centimeters in each.

To estimate hydrocyanic acid quantitatively, it is distilled into silver nitrate, slightly acidified with nitric acid, the silver cyanid collected on a filter, washed, dried, and weighed. If the precipitate is not perfectly white, it should be dissolved in ammonium hydrate and the dark residue, silver sulphid, weighed, and this weight substracted from that of the previous precipitate. From the ammoniacal solution, silver cyanid may be recovered by acidifying with nitric acid, filtering and washing; this precipitate may then be suspended in a flask, decomposed with a small quantity of hydrochloric acid, and the silver chlorid removed by filtration. The filtrate can be confirmed by the above tests for prussic acid.

NITROGLYCERIN

Nitroglycerin, spiritus glonoini, trinitrate of glycerin, is an oily liquid, slightly yellowish, almost insoluble in water, but soluble in alcohol, ether, and chloroform.

Most cases of poisoning by this agent have been accidental. Its extensive use in mining operations has caused it to be taken accidentally, occasionally, by those thus employed. One case is reported where a miner took "two mouthfuls". This was followed by a painful feeling

in the throat, and when seen by a physician an hour and a quarter later he was suffering from faintness, difficult respiration, and oppression in the chest. Later vomiting and purging set in, and shortly before death the lips became livid, and the man lay quietly, as if asleep, with feeble respiration, accompanied by an occasional sigh.

Postmortem examination showed considerable congestion of the brain, as well as the lower lobes of the lungs. The stomach had a more or less reddish-brown tinge.

The action of nitroglycerin is similar to that of amyl nitrite.

OXALIC ACID

Oxalic acid is widely distributed in nature, occurring in many plants, such as rhubarb, cinchona, and sorrel. It is a constituent of the normal urine, generally in the form of its calcium salt. It is largely used in dyeing and calico printing, and in bleaching processes, especially of straw, and in the household as a bleaching agent for ink-spots and for cleaning woodwork.

Oxalic acid is generally made by oxidizing sugar or starch with nitric acid or by the action of fused alkaline hydrates upon sawdust. It is a white, colorless body, occurring in prismatic crystals, sometimes in needles; soluble in water, freely so in alcohol, with a very acid taste and acid reaction to blue litmus. It effloresces slightly, losing its two molecules of water.

Potassium binoxalate is a salt commonly used in the household under the name of "essential salts of lemon," and the "salts of sorrel" as a bleaching agent for the removal of ink stains. It has been mistaken for cream of tartar, which it resembles in appearance and taste. Its action upon the animal economy is similar to that of oxalic acid.

Symptoms.—At first there is a very bitter and acid taste in the mouth followed by vomiting and attended by burning pain and constriction in the throat and stomach; the vomitus is dark colored and may contain blood and sometimes shreds of mucus, and is highly acid. Pains in the epigastrium also occur, but often the symptoms of nervous prostration and collapse and lack of sensation follow so rapidly the ingestion of the poison that the gastric disturbance may not be a very prominent symptom. If collapse does not occur, the vomiting is very distressing, the abdominal pain is severe, the extremities become numb, the surface is cold, and the pulse irregular or imperceptible. The rapidity with which a fatal result occurs varies considerably; in some cases it is extremely rapid.

Although death usually occurs within a short time, there are cases where it has been postponed for several days.

Lethal Dose.—Sixty grains is known to have caused death in a

youth, though the usual fatal dose for an adult is three or four times this amount. Recovery has occurred after a dose of 2 ounces.

Treatment.—The treatment should be that recommended for corrosives; the use of the stomach-pump is not advisable, but salts producing insoluble oxalates, such as magnesium and calcium in the form of their carbonates, should be administered. The wall-plaster of a room will suffice where no other agent is at hand.

Postmortem Appearances.—The postmortem appearances may be entirely lacking, although this rarely occurs. The usual appearances are white eschars, which may be yellow from the coloring matter of the blood, or brown from being colored by the bile. The gastric mucosa is not corroded, but transparent and hyperemic. White, opaque deposits in the mucosa of the stomach are due to amorphous or crystalline calcium oxalate. Perforation may occur.

Detection.—Oxalic acid may be found either as a free acid or combined with calcium, magnesium, or other bases. The detection of calcium oxalate in the urine in small amount is not indicative of oxalic acid poisoning. Calcium oxalate often appears as amorphous or crystalline deposits in the urine as the result of faulty oxidation in the animal economy, so that unless very large quantities of it are found in the urine the value of this evidence is not great.

The best method for the separation of oxalic acid from organic mixtures is as follows: the material is diluted with water and well shaken so that all of the oxalic acid goes into solution. It is then filtered from the residue containing any insoluble oxalate that may be present. The filtrate is evaporated to a thin consistency, and a large excess of alcohol added, which will coagulate any proteid present, and at the same time leave oxalic acid in solution. The residue may contain soluble oxalates. The filtrate is evaporated until the alcohol is removed and contains any free oxalic acid that was present in the original mixture. The residue which was precipitated by the addition of alcohol is acidified with hydrochloric acid and extracted with alcohol, filtered, the filtrate evaporated and taken up with water, and this solution will contain any oxalic acid that may have existed as a soluble oxalate originally. The other residue, that which remained after shaking with water, is made alkaline with a solution of potassium carbonate and boiled. The insoluble oxalates are thus decomposed into potassium oxalate. The filtrate is evaporated to a small volume, acidified with hydrochloric acid, extracted with alcohol, evaporated, and the residue taken up with water, when any oxalic acid that may have existed as an insoluble oxalate in the original material will be found in the solution.

If antidotes have been administered, such as chalk or magnesia,

the oxalic acid will have been precipitated. In this case the vomitus or stomach washings may be allowed to settle, and if not acid the supernatant liquid may be discarded. The residue or precipitate at the bottom of the vessel may be treated with dilute hydrochloric acid which will set free the oxalic acid. Filter, wash, and treat the filtrate with a solution of lead acetate. The precipitate will consist of lead chlorid and oxalate, and the oxalic acid can be isolated as follows: This precipitate is filtered off, suspended in water, and hydrogen sulphid added to decompose these salts. The lead is precipitated as sulphid, and the oxalic acid will be found in the filtrate. Filter, evaporate to dryness, and the residue will consist of more or less pure oxalic acid which can be verified by appropriate tests.

Oxalic acid forms a precipitate with the soluble salts of calcium. Calcium oxalate is insoluble in ammonia or acetic acid; soluble in hydrochloric or nitric acid. With silver nitrate, oxalic acid yields a white precipitate which is soluble in ammonia or nitric acid. This precipitate washed, dried, and heated upon platinum foil explodes. Lead acetate is precipitated by oxalic acid, the precipitate being soluble in nitric acid, insoluble in acetic acid. When heated on platinum foil, oxalic acid partly sublimes and partly decomposes.

PICRIC ACID

Picric acid is largely used as a dye and also in the manufacture of many of the high explosives. It is a yellow, crystalline body, slightly soluble in water, freely soluble in alcohol, and possesses strong coloring properties.

Its ingestion is followed by pain in the abdominal region, vomiting and diarrhea; the urine shows a reddish color, which on exposure to the air, becomes reddish-brown; there may be difficult micturition or even suppression of urine. The absorption of this poison is accompanied by great prostration, and sometimes convulsions and collapse ensue. Its elimination is slow, and a yellow staining of the skin may persist for some time. Subacute and chronic poisoning occur, as a rule, only professionally.

Its action upon the human system after absorption is to affect the hemoglobin of the blood-corpuscles, preventing the normal metabolism, and causing the formation of methemoglobin.

Tests.—A woolen thread, immersed in a solution of picric acid and rinsed lightly in water and the color extracted with ammonia, is colored red by a solution of potassium cyanid. An alkaline solution of a picrate on warming with a concentrated solution of potassium cyanid forms potassium isopurpurate which imparts a red color to the liquid.

Detection.—To recover the picric acid from the tissues, we extract

POISONING BY OXALIC ACID.

Death after five hours. Hyperæmia and contraction of the stomach with hemolysis.

with strong alcohol, evaporate the filtrate, add water, if necessary, to a syrupy consistence, acidify with sulphuric acid, extract with ether successively for several times, and unite the ethereal extracts. Evaporate off the ether after the addition of a little water, and with this solution the above test may be made.

PICROTOXIN

Picrotoxin is the bitter active principle obtained from the Cocculus indicus. The kernel, which is the only poisonous portion of the berry, has an intensely bitter taste. It is used by the natives chiefly for catching fish. It has also been used for the destruction of lice. A child's head, after the hair had been closely cut, was washed with an alcoholic tincture of Cocculus indicus. In one-half hour there were tetanic convulsions, the pupils during the spasms were exceedingly contracted, and in the interval between the attacks dilated widely. Pressure on the eye-lids produced a spasm at will. The child died in a few hours in spite of energetic treatment.

In another case of poisoning by this agent, the symptoms were faintness, mental confusion, nausea, excessive thirst, severe pain in the abdomen, weakened pulse, and slow respiration.

Picrotoxin is very slightly soluble in cold water, easily so in hot water, also in alcohol; difficultly soluble in ether, chloroform, amyl alcohol, petroleum ether. It forms colorless crystals, mpt. 195° C., which are odorless, but intensely bitter.

Detection.—To detect picrotoxin in mixtures, it is better to evaporate the material to dryness and extract with acidified water; extract this solution with ether, filter, evaporate the ethereal extract, take up with water, and decolorize with animal charcoal. Neutral lead acetate is then added, and to the filtrate from this precipitate, freshly prepared lead hydrate is added which forms an insoluble compound with the picrotoxin. This can be decomposed by suspension in water and the addition of hydrogen sulphid, and the picrotoxin extracted with ether, the ether evaporated leaving the picrotoxin in the residue. This picrotoxin can be identified as follows: With potassium bichromate in solution a green color is produced by picrotoxin. Nitric acid causes a yellowish color, which turns to a violet-red on the addition of potassium hydrate, which color changes to a blood-red or brownish-red on warming if picrotoxin is present; evaporated to dryness with nitric acid and the residue moistened with strong sulphuric acid, a brick-red color is developed on the addition of potassium hydrate if picrotoxin is present.

POISON IVY

There is another group of poisons that may be classed together, namely, poison ivy, poison oak, primrose, lady's slipper, and a few

others. The peculiar action of these is an eruption characterized by itching, irritation, vesication, and finally desquamation of the skin. The poison is due to the pollen which contains the oil, and also to minute hairs which are so abundant over the plants. The active principle is a nonvolatile oil called toxicodendrol.

The **treatment** is the application of an alcoholic solution of lead acetate. Oils should be avoided, as they assist in the absorption of the toxicodendrol.

FIG. 11.—RHUS TOXICODENDRON. (Poison Ivy.)

The swallowing of poison-ivy berries has occasionally caused accidental poisoning in children. They were attacked with dizziness, stupor, and mild delirium, and a rash resembling measles, accompanied by severe itching, developed.

PYRIDIN

Pyridin occurs in commerce as a colorless, volatile fluid with a characteristic odor and taste. Poisoning by this substance is extremely rare, and is generally accidental. The symptoms observed were nausea and vomiting, followed by lividity of the skin, a dry tongue, and a cold sweat. The patient complained of a choking sensation, with pain over the chest and over the pit of the stomach.

Postmortem appearances showed that the larynx, trachea, and bronchi were coated with a friable, yellow membrane. The bronchi contained purulent matter, and the lungs were congested and edematous.

SALOL

Salol, phenyl salicylate, is a white, crystalline powder, almost insoluble in water, with a faint aromatic odor and a slightly salty taste. It is soluble in alcohol, ether, and benzol.

The **symptoms** of poisoning which have occasionally occurred, resemble those of poisoning by carbolic and salicylic acids, namely, nausea, vomiting, increase in the body temperature, bloody urine, a sensation of tightness in the head, with ringing in the ears.

Tests.—On heating with zinc chlorid, salol is decomposed into phenol and a salicylate. The vapors produced color paper moistened with a solution of ferric chlorid a dirty green, which color is changed violet by ammonia. Both phenol and salicylic acid can be found in the urine.

SANTONIN

Santonin is a neutral principle obtained from Levant wormseed. It is a glucosid and is employed as an anthelmintic for round worms and thread worms. It has caused **symptoms** of poisoning in children more often than in adults on account of this use. A large portion of the santonin administered passes through the intestinal tract without absorption. The general symptoms which arise in cases of poisoning are disturbances of the vision, such as "yellow sight". These symptoms may continue for twenty-four hours. There may also be disturbances in the centers of taste, smell, and hearing. Large doses produce disturbances of the central nervous system, headache, giddiness, and convulsions. These symptoms may be associated with pain over the region of the stomach, vomiting, and labored respiration. Later, there may be stupor, loss of consciousness, and death from collapse. The urine is colored a saffron yellow, and as the excretion is mainly through the kidneys, these organs may be congested and irritated, and as a result of the interference the action may be said to be "cumulative". Two grains may cause death in a child; but when the kidneys are functionating normally, much larger doses may be given with impunity. But as 6 grains have produced death in a child of five years in thirty-five minutes, it is better to limit the dose for a child under six to less than 2 grains.

Treatment should consist of thorough evacuation of the stomach and bowels, with diuretics to assist in the elimination of the drug by the kidneys. To combat the collapse, heat may be applied locally; bromid of sodium or potassium and also chloral may be given for the convulsions.

The most peculiar action is the excitation of the so-called "yellow sight"; this sometimes is blue instead of yellow. If the eye-lids are closed while "yellow sight" is present, the whole field of vision appears violet. In some individuals it causes the objects to appear red, later orange, and then again yellow.

Postmortem appearances are not characteristic.

Detection.—Where santonin is to be separated from organic mixtures, the material is rendered slightly alkaline with sodium hydrate, dialyzed and then mixed with three times its volume of alcohol. The mass is filtered after standing twenty-four hours, the alcohol evaporated off, and the remaining liquid shaken with benzol. After the removal of the impurities in the alkaline solution, hydrochloric acid is added, and the solution again shaken out with benzol or chloroform. The chloroform and benzol extracts on evaporation will leave the santonin as a residue, which can be identified as follows: Santonin dissolved in sulphuric acid and with the addition of a very dilute solution of ferric chlorid in small successive amounts, produces a red to purple or violet color on

shaking. Santonin heated with an alcoholic solution of nitrate of ethyl develops a violet color when potassium hydrate is added.

SAVIN

Oil of savin is a limpid, almost colorless liquid, having the disagreeable odor of the plant and a bitter taste. The use of the oil and of the dried leaves of the plant is extremely limited in medicine, but as it is so frequently used for the purpose of producing abortion, it is necessary to know its effects. When applied to the skin it exerts a powerful rubefacient action, even causing vesicles. In small doses, in the form of an infusion of the leaves or the oil, the tongue perceives a bitter taste which is followed by peculiar pains in the stomach. Ingested in large doses it produces symptoms of irritant poisoning, such as epigastric and abdominal pains, greenish vomitus, abundant and often bloody stools, salivation, and other symptoms of intestinal irritation. The nervous symptoms are those of stimulation, followed by prostration and collapse. The respiration is at first hurried, later becoming slower, and unconsciousness follows, sometimes preceded by convulsions. Often the urine is bloody and hemorrhages may occur also from the nose and lungs. But the congestion is generally noticed in the genito-urinary system, and hemorrhages may take place from the uterus, and in the pregnant female the fetus may be expelled. However the action of the drug may be explained, there is no doubt that it causes considerable local congestion of the pelvic viscera and the genito-urinary apparatus. One author states that it is the most certain and most powerful of the emmenagogs. Although its power of producing abortion cannot be denied, still it is the general rule that this only occurs when it is taken in such doses that life itself is endangered by the violent inflammation that is set up in the intestinal canal, and that it may even destroy the life of the pregnant female without causing abortion.

The volatile oil expressed from a small gland situated at the back of the leaves of the plant is much more active than the extract, and the fresh extract is more active than the dried.

The **symptoms** produced are those of irritation of the gastro-intestinal tract, also irritation of the kidneys and bladder. In extreme cases also difficult respiration, anesthesia, convulsions, and coma.

Postmortem we find undoubted evidence of inflammation of the stomach and intestines. The contents of the stomach are generally greenish in color. In one case the stomach was found softened and perforated, its contents emptying into the abdominal cavity, causing extensive peritonitis.

Detection.—Powdered savin may, on account of its green color, be mistaken for bile. If the material is allowed to settle, and if no bile is

present, the savin will separate at the bottom of the vessel, and the fluid above be without any green color. Where a decoction or infusion of the leaves has been employed, it is almost impossible to detect it. If the oil has been administered, it may be separated by distillation. Microscopic examination of the powder may be used as a test, and the odor also may aid in its recognition.

STROPHANTHUS

Strophanthin is the glucosid of the seeds of Strophanthus hispidus. It is a cardiac poison, and in many respects produces symptoms similar to those described under Digitalis.

From experiments upon animals, apparently the striped muscles of the body are affected, as shown by the twitching of groups of muscles, and their tonicity is exaggerated and finally exhausted. Probably the reflex action of the spinal cord is sustained after the paralysis of the heart.

The strength of this glucosid varies, as it is easily decomposed. When freshly prepared, a slightly increased dose may cause unusual and severe action upon the heart.

Isolation.—Strophanthin occurs in white, crystalline plates, slightly soluble in water, with a bitter taste, quite soluble in ethyl and amyl alcohol, insoluble in ether and benzol. It may be extracted from the acid aqueous extract by shaking with amyl alcohol, as described under Morphin. With sodium nitroprussiate and ammonium hydrate, strophanthin gives a red color. With a drop of ferric chlorid, strophanthin gives, on the addition of sulphuric acid, a red-brown precipitate, gradually becoming green. The physiological test is best shown by the arrest of a frog's heart in systole.

SULPHONAL

Sulphonal is the proprietary name of diethylsulphondimethylmethane. It is a colorless, odorless, almost tasteless, crystalline body (mpt. 125° C.). It is freely soluble in boiling water, very slightly in cold, freely soluble in hot alcohol. Recently it has been used extensively as a hypnotic drug. In large doses it is a poison.

The **symptoms** of poisoning are sleep, followed by coma and accompanied by a cold, clammy skin; slowing of the respiration and circulation, sometimes an increase in body temperature; the urine may become entirely suppressed, and what is excreted is generally reddish-brown in color, due to the presence of hematoporphyrin. In some severe cases there is stertorous breathing, almost imperceptible pulse, and marked cyanosis. Sleep and coma have persisted for six days and recovery taken place.

The continued use of sulphonal to produce sleep causes a form of chronic poisoning, the symptoms of which are headache, vomiting, albuminuria, suppression, and a peculiar coloration of the urine by hematoporphyrin.

The effect on different people who have taken sulphonal shows that there is considerable difference in regard to the size of the dose which may produce poisonous effects. A single dose of 20 grains has produced in one case alarming symptoms or muscular weakness and prostration.

Treatment.—In acute poisoning, washing out of the stomach, the administration of diuretics, purgation, and the administration of strychnin in chronic cases is the appropriate treatment.

Tests.—Sulphonal heated with potassium cyanid develops the odor of mercaptan, and potassium sulphocyanid is formed. The fused mass is dissolved in water and yields a red color on the addition of ferric chlorid.

Heated with powdered charcoal, sulphonal gives off mercaptan, which can be recognized by its odor, sulphur dioxid, which can be recognized by its bleaching properties, and acetic and formic acids, which may be recognized by turning blue litmus-paper red.

Organic mixtures should be first extracted with alcohol, the alcohol evaporated, and the residue extracted with boiling water, the water evaporated, and this residue extracted with ether. Sulphonal is left as a residue from the ethereal extract and may be crystallized from boiling water. Its melting-point will aid the identification.

If one of the methyl groups of suphonal is replaced by an ethyl group, **trional** is formed. If both methyl groups are so replaced, we have **tetronal.** Both are similar to sulphonal in their properties and action.

TANSY

Tansy contains a volatile oil which is occasionally used as an anthelmintic. Its action is similar to that of oil of turpentine, etc.

The oil of tansy has often been taken for the purpose of producing abortion, but it does not apparently produce this action, although popularly supposed to do so.

The **symptoms** of poisoning are similar to those caused by savin—collapse, cyanosis, and narcosis, followed by convulsions.

The symptoms are a sense of heat and discomfort in the stomach and bowels, attended with giddiness, prostration, disturbance of circulation and respiration, followed by coma which is sometimes preceded by convulsions.

One case is reported where the quantity taken was less than 1½ ounces, and death took place in 3½ hours. The girl when first seen had

fallen out of bed in convulsions and was unconscious. The cheeks were highly flushed, the eyes open and brilliant; the pupils widely dilated and insensible; the skin was warm; the pulse full, rapid, and strong; respiration hurried and obstructed by an abundance of frothy mucus which filled the air-passages and was blown from between the lips on respiration; the breath had a strong odor of tansy; convulsions occurred every five or ten minutes, during which the respiration was suspended, the fingers contracted, and the arms raised and extended.

Postmortem this case did not show any characteristic appearances. The brain was not congested in any part nor was there any effusion. There was no apparent congestion of the lungs. There was a strong odor of tansy in the peritoneal cavity. A four months fetus was found in the uterus not in the least disturbed.

There are no characteristic **chemical tests.** The detection of this oil in cases of poisoning is, as a rule, easily made by its peculiar and powerful odor.

TARTARIC ACID

A few cases of poisoning by tartaric acid have been recorded, one of which was fatal. The patient had taken tartaric acid by mistake for epsom salts.

The **symptoms of poisoning** seem to be the result of the severe vomiting and diarrhea which are caused by the local action upon the digestive tract.

Postmortem changes appear as an acute inflammatory condition of the mucous membrane of the whole digestive tract.

The **chemical detection** is difficult because tartaric acid is a constituent of many ordinary foods and cooking salts; therefore, in many cases of poisoning by tartaric acid, large quantities of it must be isolated from the stomach contents. The stomach contents are diluted with water, filtered, and the filtrate divided into two equal portions. One portion is neutralized with potassium hydrate, then added to the other portion, and the mixture shaken actively and allowed to stand for some time, when nearly all of the tartaric acid will be precipitated in the form of cream of tartar, and can be easily identified.

TURPENTINE

Turpentine is a volatile oil obtained by distillation. It is a colorless liquid, boiling at 160°, is almost insoluble in water, soluble in alcohol, ether, and glacial acetic acid. It has a hot, burning taste, and when applied to the skin causes severe irritation. Its principal use is that of a solvent. Poisoning has resulted from its use as an anthelmintic. It

has been the cause of accidental and suicidal death, but has rarely been used for homicidal purposes.

The **symptoms** after a fatal dose of the oil are usually burning pain in the mouth and throat, followed by vomiting and diarrhea; difficult micturition sometimes accompanied by bloody urine, the urine having a violet-like odor; muscular twitchings and coma followed by death.

People sleeping in a room newly painted, where oil of turpentine has been used, as well as in factories, are often subjected to symptoms of poisoning by its vapor. The symptoms are dizziness, mental depression, and those mentioned above.

The use of the stomach pump and cardiac stimulants should be employed.

Chemical **tests** are not very satisfactory, but a few of the reactions may be mentioned. A paper dipped into turpentine and introduced into a jar of chlorin gas inflames spontaneously. Iodin and bromin act in a similar way. The oil is very inflammable.

CHAPTER V

ALKALOIDAL POISONS

ACONITE

The leaves and root of the Aconitum napellus contain one of the most fatal poisons known. The leaves have proved fatal when eaten by mistake for salad, and the root, by its resemblance to horseradish, has caused many accidents. The root is tapering, about the thickness of a finger at its upper part. Its color externally is brown; internally it is white; it has a bitter taste, and after a few minutes a peculiar numbness and tingling are noticed on the lips and tongue. The leaves have the same taste and when chewed produce the same peculiar sensation.

Aconitin is the chief of the poisonous alkaloids of Aconitum napellus, commonly known as monkshood. Aconitum contains several other alkaloids, aconin, napellin, lycaconitin, myoctonin, and others. The last two mentioned are amorphous, very poisonous alkaloids, obtained from Aconitum lycoctonum. The chemistry of these alkaloids is not very definite, but it may be that some of them are derivatives of aconitin, and as the symptoms produced by them all are very similar, the discussion of aconitin will be taken as typical of the others.

Fig. 12.—Aconitum napellus. (Aconite.)

Aconitin is a crystalline alkaloid, soluble in water, easily soluble in chloroform and benzol; somewhat so in alcohol and ether. It is easily decomposed by acids and alkalies, and even the presence of other substances may decompose it on boiling, which makes its detection difficult. It gives no characteristic color tests, and its detection is chiefly dependent upon its physiological action.

Symptoms.—At present the preparations are made only from the root. When preparations were formerly made from the leaves and the root, symptoms were more common, on account of not knowing the strength of the alkaloid contained in the preparation. The active principle aconitin is very variable in its poisonous strength and, according to some authors, $\frac{1}{50}$ of a grain has endangered life. On the other hand, $2\frac{1}{2}$ grains have been taken and recovery followed.

The numbness and tingling caused by the ingestion of this alkaloid and experienced first in the mouth soon extends to every part of the body. The face has an anxious appearance, with paleness of the lips, swollen eye-lids, pupils somewhat dilated and insensible to light; respiration is increased, the pulse weak and feeble; consciousness is preserved, but the patient is often unable to walk on account of muscular weakness; in addition, there is very great restlessness. Where there are severe symptoms of poisoning, the pulse grows weaker, irregular, and finally almost imperceptible; the surface of the body is cold and respiration labored. This may be followed by convulsions, and death ensue within a few hours. Vomiting and purging are not unusual symptoms where the alkaloid has been taken in considerable quantity.

The **lethal dose** is variable. Twenty-five minims of the tincture have been reported as causing death, and this may be said to be the minimum dose. Of the alkaloid itself $\frac{1}{16}$ of a grain is generally fatal, and probably one-half of this will cause severe symptoms, if not death. The difficulty in stating more accurately the minimum dose is owing to the fact that the aconitin preparations are not always of uniform strength.

Treatment.—In cases of poisoning by this alkaloid empty the stomach by means of the pump; finely powdered charcoal or tannic acid should be first administered in order to render the alkaloid insoluble; heart-stimulants should then be given, such as carbonate of ammonia, and also subcutaneous injections of strychnin; especially should the patient's body-surface be kept warm, and electrical stimulation may be employed if necessary.

The action of this alkaloid seems to cause a paralysis of the respiratory functions and the pulsations of the heart, due first to the irritation, and then to the exhaustion of the vagus nerve.

Postmortem we find hyperemia of the cerebral membranes, and fullness of the venous system. When aconitin is administered subcutaneously, there are no inflammatory appearances either in the stomach or intestines. One case is reported where there was observed a peculiar paleness of the skin, like marble; the pupils were moderately dilated, and the color of the large intestine pale; the duodenum, especially near the stomach, much congested; the gastric mucosa was very hyperemic; the spleen enlarged; the liver and kidneys were also deeply congested, as well as the lungs, and the right ventricle of the heart was distended with blood. In another case, where a man died three hours after eating a small quantity of aconite root, the only abnormal appearance was a slight reddish-brown patch at the cardia of the stomach.

Detection.—The detection of aconite depends upon discovering portions of the plant microscopically, if the plant was ingested. After the isolation of the alkaloid, its presence can be confirmed by the peculiar

physiological effect upon the lips, tongue, and skin; and if enough is at hand, by administering a portion to an animal and noticing the physiological action.

Strong sulphuric acid dissolves aconitin with the immediate formation of a yellow-colored solution which, if it contains enough of the alkaloid, soon becomes brown, later violet, and finally colorless. Phosphomolybdic acid precipitates aconitin from very dilute solutions as a gray precipitate which becomes bluish after a while. Tincture of iodin, chlorid of gold, tannic acid, as well as Mayer's reagent precipitate it from moderately dilute solutions.

The principal reliance must be placed upon the physiological test, 0.0006 gram sufficing to produce peculiar sensations when applied to the skin; 0.0002 gram will poison a mouse with characteristic symptoms.

The isolation of aconitin from organic mixtures is best accomplished by Dragendorff's method. If we are fairly sure from the symptoms of the case that aconite is the cause of the poisoning, we may shake the acid solution with naphtha to remove certain impurities and then shake the solution, made alkaline, with benzol, when the aconitin will be found in the residue left after separation and evaporation of the benzol, and can be confirmed by the above tests. Aconite resists decomposition fairly well, and may be detected for a considerable period after death.

COCAIN

Cocain is the alkaloid obtained from the leaves of Erythroxylon coca, and is widely used in medicine and surgery. The alkaloid itself crystallizes in prisms; dissolves slightly in cold water, easily in alcohol, ether, benzol; chloroform, wood alcohol and petroleum dissolve it when hot, but on cooling the alkaloid separates immediately. It is easily decomposed, even in the living body, and ecgonin, one of its decomposition products, may be found in the urine. As used in medicine, cocain is met with as its hydrochlorid, a salt which crystallizes in prisms or scales, is easily soluble in water and chloroform, almost insoluble in alcohol, ether, benzol, and ligroin. The principal preparations of this drug are the fluid extract and cocain hydrochlorid.

The **symptoms** of cocain poisoning vary widely in different individuals. Small quantities of the alkaloid produce excitement of the mind which may be agreeable to the subject. The mental condition is sometimes anxious or confused. On the other hand, a small dose may produce a state of discomfort similar to that of a small dose of morphin, with possibly the exception of producing sleep. The pulse and respiration are quickened, the pupil of the eye is dilated, and headache supervenes. Like morphin, cocain causes an increase in reflex action, which may be

exhibited by muscular trembling of a convulsive nature. The convulsive effect is often absent and the patient falls into a state of collapse.

Its local action is that of an anesthetic, apparently due to paralysis of the ends of the sensory nerve, except those which are sensitive to heat and cold. Applied to the surface of the unbroken skin, the loss of sensibility is but slight, because the absorption is so slow. Where the epidermis has been injured, the effects produced by local application are similar to those produced by internal administration. Besides the loss of sensation following the local application of cocain to the mucous membrane, there is a distinct feeling of constriction in the throat which is noticed by the paleness of the mucous membrane.

FIG. 13.—ERYTHROXYLON COCA. (Cocain.)

The application of cocain to the surface of the eye abolishes in that organ the sensation of pain. This is followed by dilatation of the pupil, with partial loss of muscular power and accommodation. This dilatation is much less than that produced by atropin.

Cocain has to a certain extent replaced morphin eating. The substitution of cocain for morphin does not relieve the craving for the use of the latter, and we notice the effects of both these alkaloids.

The SYMPTOMS OF CHRONIC POISONING or cocainism are disturbances of digestion, loss of appetite, salivation, followed by sleeplessness, hallucinations, muscular convulsions, and these followed by delirium.

In addition to the local anesthetic properties so commonly used in surgery, cocain has been used to produce anesthesia in major surgical operations. This is so serious a method, requiring dangerous doses of the drug, that it is rarely used. The symptoms experienced where too much cocain has been used under such circumstances are similar to those described above.

Lethal Dose.—Two-thirds of a grain of cocain administered subcutaneously caused the death of one woman in a few hours.

The **treatment** should consist in the administration of amyl nitrite where there is high blood-pressure; chloroform or ether can be inhaled if necessary to counteract convulsions. If the poison has been ingested, the stomach should be washed out and respiration promoted by the

inhalation of ammonia or, if necessary, artificial respiration and the inhalation of oxygen.

The action of cocain is both upon the central and upon the peripheral nervous systems. In small doses the spinal cord and brain are excited, with large doses convulsions and paralysis ensue. The action on the central nervous system interferes with accommodation of vision, and causes dilatation of the pupils, and also may produce paralysis of the vagus nerve.

Postmortem appearances are those usually seen in cases of death from asphyxiation.

The **detection** of cocain is difficult, and reliance is to be placed generally upon its physiological action and, to a certain extent, upon the formation of benzoic acid after saponification. The physiological test is the feeling of numbness and insensibility to touch. With strong solutions there is blanching of the mucous membrane and dilatation of the pupils, although this is not so noticeable as with atropin. Cocain chlorid causes a violet, crystalline precipitate with potassium permanganate. Ferric chlorid produces a yellow solution, which turns orange, and then red.

It is best separated from organic mixtures by Dragendorff's method.

FIG. 14.—PHYSOSTIGMA VENENOSUM. (Calabar Bean.)

CALABAR BEAN

Physostigmin or eserin is the chief alkaloid obtained from the seeds of Physostigma venenosum. It occurs in Western Africa. It has given rise to several cases of accidental poisoning in children who ate the beans.

The **symptoms** began with weakness of the voluntary movements, with peculiar muscular tremblings and twitchings, especially of the lower part of the body, and these soon extended to the whole body. Salivation and lachrymation are produced and there is violent diarrhea and vomiting. The respiratory movements are at first rapid and deep, later slow and difficult; the pupils are contracted and the symptoms increase in intensity until respiration ceases and death from asphyxia ensues.

Its action is similar to that of nicotin in that it inhibits the reflex action in the central nervous system. Excitement of the spinal cord and brain, followed by exhaustion of their function, occurs probably

as a result of repeated doses which exaggerate the symptoms. It occasionally produces the cumulative effect where it has been used in repeated doses.

The **lethal dose** is not known. Six beans were fatal to a boy of six years.

The alkaloid undergoes decomposition, except when kept from the light and air, and soon loses its activity.

Properties.—Physostigmin is slightly soluble in water, easily so in alcohol, ether, chloroform, benzol, etc. It is also easily soluble in dilute acids and alkalies. Their solutions are colorless, but when exposed to the light, especially when kept in a warm place, they become a beautiful red. There are no characteristic color reactions for physostigmin. The best test is the physiological one, producing contraction of the pupils.

Its **isolation** from organic mixtures is difficult, as the alkaloid is so readily decomposed in acid and alkaline solutions, both by heat and light. It is not very stable after death, and cannot be detected in the tissues after marked decomposition has set in. It may be isolated by Dragendorff's method.

CONIIN

Coniin is an alkaloid which has been isolated from Conium maculatum, ordinarily known as poison hemlock. There are other alkaloids derived from hemlock, but they are not of very great importance. The plant resembles in appearance "fool's parsley", and has sometimes been eaten by mistake. These two plants can be distinguished from each other by the dark spots found on the thicker portions of the hemlock stems, but these spots are not found on the stems or branches of hemlock smaller than the little finger.

The number of cases in medical literature of poisoning by this drug is not large, although both in England and in this country it has caused poisoning, generally by accident. The leaves are the most poisonous portion of the plant.

Symptoms.—Its action upon the human system is not well known. Some authors state that it possesses narcotic properties, and others deny it. The cause of the difference of opinion is probably due to the different preparations of hemlock that have been used. In one case where an experiment was made upon an adult no effect of sleep resulted, merely a sense of fullness in the head and a tendency to vertigo. Another man experimented upon himself and experienced lightness in the head, dimness of vision, and a numb, prickling sensation was felt in the fingers, gradually extending to the elbows, and producing a stiffness of the muscles which made it difficult to move the forearm and hand. In a few moments the same sensation was observed in the feet until it reached

the upper part of the thigh. The eyes then began to feel uncomfortable and caused him to brush them frequently to remove apparent obstructions from the lids. Dismounting from his horse he found so much difficulty in walking that he required assistance, the lower limbs apparently being paralyzed.

When the dose taken is large the victim experiences physical languor, disturbed vision, dizziness, and he may fall from muscular weakness of the limbs. The muscles of the eyes are incapable of accommodation; there is nausea, with abdominal pain, vomiting, diarrhea, and headache; difficulty in breathing, also in swallowing; drowsiness, followed by convulsions and coma; sometimes delirium occurs if death is delayed.

Two grains is probably a **fatal dose,** and from ½ to 1 grain a dangerous dose.

Treatment.—Evacuation and washing out of the stomach is the only treatment that has met with any success in animals. The body temperature should be kept up with hot applications, and tannin or strong tea may be given to precipitate the alkaloid.

Postmortem appearances are not characteristic.

FIG. 15.—CONIUM MACULATUM. (Poison Hemlock.)

Properties.—Coniin is a colorless, volatile fluid which on exposure to light and air becomes darker and is partly transformed into a resinous substance; it has a peculiar odor, said by some to resemble that of the urine of mice. It is only very slightly soluble in water, more so in cold than in hot; it is also soluble in alcohol, benzol, chloroform, etc. Phosphomolybdic acid, solution of iodin in potassium iodid, and iodid of bismuth and potash are the chief precipitants for this agent. Coniin resembles in many respects bases that have been isolated from putrefactive products, and great care should be exercised in differentiating these bases from various ptomains and toxins.

Phenolphthalein gives a red color with coniin, but no reaction with nicotin; this reaction is more marked in the presence of chloroform.

Dry chlorin gas produces a purple to blue color when passed over coniin. Hydrochloric acid, when near a solution of the alkaloid, produces a white cloud, converting the coniin into a crystalline mass of needles.

Coniin can be isolated from organic mixtures in a similar way to nicotin. It is very readily eliminated by the kidneys, and can be detected in the urine. It withstands decomposition for a long period of time.

FIG. 16.—CICUTA MACULATA. (Water Hemlock.)

Dr. Harley, in the Gulstonian lectures of 1868, gives a special method for the detection of this agent.

Water hemlock, Cicuta maculata, cowbane, and **Cicuta virosa** have produced symptoms of poisoning. The symptoms are very similar to those caused by coniin, such as vomiting, muscular weakness, and twitching, paralysis, convulsions, and unconsciousness. The treatment is similar to that for coniin poisoning.

Cowbane grows wild in many parts of the United States, and is also sometimes cultivated. Its leaves have been mistaken for parsley and have caused cases of accidental poisoning. The symptoms of poisoning are similar to those produced by Œnanthe crocata. These symptoms are nausea, vomiting, colicky pains, and loss of consciousness; soon facial muscular twitchings, increased respirations, and paleness, giving way to cyanosis, later followed by convulsions, during which there is marked opisthotonos and gnashing of the teeth. In fatal cases death occurs from asphyxia, and the patient may remain unconscious and die comatose.

POSTMORTEM we find the mucosa of the stomach injected which may extend to the intestines.

Œnanthe crocata, water dropwort, is another of these poisonous plants which may be considered in conjunction with hemlock. Animals poisoned by it were seized with frothing at the mouth, shivering, difficult respiration, and finally death. In man, abdominal pain, diarrhea,

vomiting, weak and slow pulse, dilated pupils, collapse, later delirium and convulsions may ensue.

There is no record of any characteristic postmortem appearances.

GELSEMIN

Gelsemin is a crystalline alkaloid obtained from the yellow jasmine. From this same plant gelsemic acid and an amorphous alkaloid, gelseminin, have been isolated. Gelsemin occurs both amorphous and crystalline. It forms crystalline salts with chlorin and bromin. It is only very slightly poisonous, producing in frogs the same action as strychnin. In mammals it is apparently without action. It is easily soluble in alcohol, chloroform, and ether.

Gelseminin is a colorless, amorphous base which turns yellow on contact with acids; its salts are amorphous, insoluble in water and alcohol. It is a powerful poison, resembling coniin.

The identity of gelsemic acid and the glucosid, esculin, has been maintained by some authors. They are probably not the same substance. Gelsemic acid is only very slightly soluble in water at the ordinary temperature, rather freely soluble in chloroform.

The **symptoms** caused by a small dose of the extract of gelsemium are muscular weakness and languor, although the susceptibility of the individual varies. Larger doses, in addition to the above, produce certain nervous phenomena, such as dizziness and frontal headache, which may be intensified; the gait becomes tottering, the eye-lids droop and cannot be raised. The cutaneous sensibility is diminished, the respiratory movements and the pulse become slow, cold perspiration breaks out, and the temperature of the body is lowered. Death usually comes from paralysis of the respiratory nerve-center.

The **treatment** should be to empty the stomach repeatedly. The circulation may be excited by stimulants, such as hot drinks, and external heat and artificial respiration used if necessary.

Tests.—Sulphuric acid and a small crystal of potassium bichromate with a gelsemium alkaloid produce a red to purple color in streaks along the path of the crystal. When a control experiment is performed with strychnin there will be no mistaking its reaction. Ferric chlorid and ferric cyanid produce an intense green color with gelsemin, but not with strychnin. This alkaloid can be isolated from organic mixtures by the method described under Opium.

NICOTIN

The tobacco plant contains a volatile, poisonous liquid called nicotin. This alkaloid probably occurs in the plant in combination with citric and malic acids. Some cases of accidental poisoning by this plant have

been reported. Many accidents have occurred from swallowing crude tobacco, and from children playing with old pipes, many of which have resulted fatally.

The **symptoms** are an unpleasant sensation in the mouth and throat, salivation, and an uncomfortable feeling spreading from the epigastrium to the extremities of the body. Headache, giddiness, numbness, hearing dulled, and respiratory movements increased occur after the ingestion of a large dose; with still larger doses, great faintness, physical depression, and weakness; the limbs become cold and the face pale. Later nausea and vomiting occur. Occasionally there has been noticed shivering of the extremities and cramps in the muscles of the back. Where death has occurred, the heart's action has continued even after respiration has ceased.

FIG. 17.—NICOTIANA TABACUM. (Nicotin.)

The symptoms of acute poisoning are similar to those produced in many people when they smoke for the first time, namely, nausea, vomiting, a sensation of heat in the throat and stomach, colic, diarrhea, frequent micturition, great anxiety, and coldness of the extremities; the pulse is small, weak and intermittent; the breathing is labored; there is paralytic relaxation of the voluntary muscles; the pupils are only slightly affected. This state is followed by utter prostration, but not coma, and may terminate in death. Swallowing tobacco may cause serious symptoms, and even death.

Lethal Dose.—The lethal dose of tobacco leaves seems to be from ½ to 1 ounce.

If tobacco has been swallowed, efforts should be made first to the washing out of the stomach to remove the drug. Stimulants, external heat, artificial respiration, and even the inhalation of oxygen should be practiced. Heart stimulants may be necessary, such as strychnin.

Nicotin is apparently removed by the kidneys and, to a certain extent, by the saliva. The exact action of the drug upon the human economy is at present unknown. Large doses apparently paralyze both the controlling and exciting nerve-centers, producing at first an increase, and later a diminution in the blood-pressure.

The **postmortem appearances** in most cases where death has been caused by nicotin were not characteristic.

The **isolation** of nicotin from organic mixtures is the same as that

described under Opium. Although the nicotin is volatile, it does not easily escape from the body after death and can be detected for some time. It is most readily detected in the contents of the stomach and intestines, and may also be found in the liver, heart, lungs, and kidneys, as well as in the blood

The physiological test is perhaps the best, and for this purpose a frog is the most susceptible.

Properties.—Nicotin is a transparent, colorless, oily liquid, turning brown upon exposure to the air. It has an acrid and burning taste, is soluble in alcohol, water, ether, and oils. Its aqueous solution has a strong alkaline reaction, and with sulphate of copper produces a deep blue color similar to the action of ammonia on copper solutions. It is readily precipitated from its solution by phosphomolybdic acid, trichlorid of gold, corrosive sublimate, etc. If an ethereal solution be added to an ethereal solution of iodin, a brown, amorphous precipitate is first formed, which later becomes crystalline. Warmed gently with hydrochloric acid, it gives a violet color which becomes red on the addition of nitric acid. A glass rod moistened with hydrochloric acid and held near a watch glass containing nicotin produces a white cloud similar to that produced by coniin, but no crystals are formed.

OPIUM

Opium is the dried juice of the Papaver somniferum, a poppy which is indigenous chiefly to China, India, Asia Minor, and Egypt. It contains various active principles, the chief of which is morphin, 12–16%. Other alkaloids are codein, 0.03%; narcein, 0.02 to 1%; narcotin, 1.3 to 11%; thebain, 1%; meconic acid, 3 to 4.3%, and traces of other less important bodies, such as hydrocotarnin, laudanin, etc. Morphin, codein, narcotin, thebain, narcein, and papaverin are poisonous to the lower animals, but morphin is the only one that has been recorded as producing death in man. As morphin is the chief alkaloid of opium, and is that portion of it which is poisonous to man, we shall take up this alkaloid rather than the crude substance itself.

Morphin occurs in opium combined with meconic acid, and also with sulphuric acid. In chemical investigation, morphin and meconic acid are the two most important constituents, as they are the ones that are usually separated and identified. Meconic acid has not been found in any other substance, and, consequently, when detected it implies that opium and not morphin only has been given.

Symptoms.—Morphin given to a healthy person in sufficient amount to produce poisonous effects is followed by a group of symptoms ordinarily called those of opium narcosis; fullness or dizziness in the head, accompanied by a feeling of mental and physical ease; increased intel-

lectual activity, and a rather rapid pulse; sometimes there may be an unpleasant sensation of itching of the skin, especially upon the nose and forehead, and this may occasionally even interfere with the effect of the action of producing sleep by this drug. Nausea and vomiting may be early symptoms, and often when a single overdose is taken these symptoms may be so severe as to cause the rejection of the poison and thus prevent the absorption of a sufficient amount to cause death. Attempts at criminal and suicidal destruction have often been thwarted in this way.

In medicinal doses the symptoms produced are entirely different from those following a poisonous dose. Lassitude, headache, drowsiness, stupor, and complete insensibility which may pass into coma, and generally preceded by stertorous breathing, are the symptoms often caused by poisonous doses. During this, reflex action to external noises and the irritation of the skin is much increased and the patient can be aroused, though he immediately relapses into his former state. During coma it is impossible to arouse the patient by noise. The respiratory movements are peculiar and are recognized under the name of narcotism or narcosis, being at first hurried, later difficult, irregular and slow, even such as is described under the name of "Cheyne-Stokes respiration"; later the skin becomes moist and cold because the secretions are arrested, and there is relaxation of the muscular contraction. In the early stages the pupils are contracted and insensible to light; later they may be dilated, remaining insensible to light, and generally this latter symptom is a sign of a fatal termination. Generally constipation is present, though occasionally there may be slight diarrhea. Vomiting occurring before the onset of the stupor is a favorable sign for recovery. The peculiar odor of opium may be recognized on the breath, and thus the differential diagnosis made from alcoholic narcosis. This peculiar odor is not noticed when morphin or its salts have been used.

FIG. 18.—PAPAVER SOMNIFERUM. (Opium.)

In fatal cases of acute poisoning, the pulse is extremely feeble, the pupils dilated and not reacting to light; muscular relaxation is shown by the falling of the lower jaw, and by the action of the sphincter muscles. Occasionally the patient recovers from the immediate severe symptoms,

only to relapse into unconsciousness, coma, followed by death a few days later.

Although carbolic acid poisoning has been mistaken for that by opium, the peculiar odor of the acid should enable one to distinguish it. The slow elimination of morphin must be taken into consideration, especially in those cases where the kidneys and other secreting organs are unable to do the normal amount of work. Fatal effects of morphin poisoning are more prevalent for this reason, even though the morphin is given in small doses.

A sufficiently large dose or small repeated doses produce a very marked contraction of the pupils and generally a loss of sensitiveness on the surface of the eye-ball. This is more or less peculiar to morphin poisoning. With poisonous doses the length of time that the patient experiences intellectual excitement or exhilaration is almost so short as to escape observation, and the various symptoms described above follow each other so rapidly that the patient may fall into a deep sleep, from which he can be aroused, but which is soon succeeded by coma, stertorous breathing, slow and almost imperceptible pulse, cyanotic countenance, cold and clammy extremities and contracted pupils, and just before death asphyxia occurs and the pupils dilate. The urine is generally albuminous and often contains casts. If the kidneys are diseased, this, as before mentioned, interferes with the elimination of this agent, and may produce a fatal termination, even though small doses have been used.

Delirium is rare, and in adults convulsions have seldom been observed; in children they are, however, not uncommon.

The symptoms of narcosis by other drugs and that by opium may well be mentioned here. Aconite, tobacco, and digitalis do not produce stupor, nor does coniin except in excessive doses, and then not always. Hyoscyamus and belladonna produce violent delirium and extreme dilatation of the pupils; alcohol narcosis is very similar to opium narcotism, but the former is often preceded by confusion of ideas and delirium and the breath smells strongly of alcohol.

The onset of the symptoms after the ingestion of opium or its various preparations is quite rapid, generally within an hour; the average duration is said to be from eleven to twelve hours. The various preparations of opium, such as laudanum, are much more rapidly absorbed than the crude drug, and hence the symptoms may come on very rapidly.

Opium may also cause chronic poisoning. It generally results from originally using morphin for the relief of pain, especially when it has been given subcutaneously.

Morphin, as such, is rarely used in medicine. It is generally used in

the form of one of its salts, such as the sulphate, which is about three-fourths by weight morphin. The onset of the symptoms is much more rapid, where it has been given subcutaneously, and occasionally by this means of administration it has been injected into a vein, causing almost immediate results.

Children are much more susceptible to poisoning by opium or its derivatives than are adults, even when the difference in age is taken into consideration. Under five years, children should not receive more than $\frac{1}{20}$ to $\frac{3}{20}$ of a grain. In adults, not addicted to the use of the drug, 1 to 3 grains will cause symptoms, often death. In those who have the "morphin habit" very large doses may be taken without the production of any of the acute symptoms of poisoning. By subcutaneous injection, $\frac{1}{8}$ to $\frac{1}{6}$ of a grain is a safer dose to begin with. Fatal results have occurred even after the subcutaneous injection of $\frac{1}{4}$ grain. People exhibit various degrees of susceptibility to the action of opium, so that it is impossible to say definitely what a fatal dose will be. One-twentieth of a grain of opium has produced death in a child six days old. Five drops of laudanum injected into the rectum of a child one and one-half years old caused death in six hours, and alarming symptoms may be produced by a few drops of laudanum or a small dose of Dover's powder when given to a child. On the other hand, excessively large doses of opium and its derivatives have been taken, and recovery followed. An elderly man of seventy-two recovered after taking 12 drams of laudanum, and another, aged thirty-five, recovered after taking $\frac{1}{2}$ ounce.

Idiosyncrasy plays a large rôle in modifying the usual effects of opium and may be of importance in medico-legal investigation. A case is reported where $\frac{1}{2}$ grain of opium produced narcotism in a woman, and another case where 7 drops of laudanum produced the same symptoms in a man. Some diseases render the system very susceptible to its action; but on the other hand, painful diseases enable a person to use extremely large doses, not only without injury, but with decided advantage.

The habit of taking opium diminishes the influence of this drug upon the system, and a dose may be taken by a person who indulges in this habit, which would be absolutely fatal to one not accustomed to its use. As a rule, such people die from lack of nutrition and from cerebral disease. The following description of the effects of the continued use of opium is given by a Mr. Little, of Singapore: "As the habit grows upon its unhappy victim, the first evils experienced are disturbed sleep, watchfulness, giddiness, sometimes headache, capricious appetite, a white tongue, frequently costiveness, an indescribable oppression in the chest, and haziness of the eye. Finally, a copious secretion of mucus takes place from the eyes, and often from the nose and mouth; digestion

becomes much impaired and micturition difficult; a mucous discharge begins to flow from the organs of generation; the sexual organs at first preternaturally excitable, gradually lose their tone; the body wastes and the muscles lose their tonicity; the joints are affected with dull, gnawing pains for some hours in the morning. By and by the figure stoops and a peculiar, shuffling gait is acquired, by which alone a practiced eye may recognize an old opium debauchee. At the same time the eye-brow droops, the eye-lids become dark, and the eye itself seems to sink and grow dim, while the expression is that of premature old age. In both sexes the procreative power is greatly lessened, and in those women, who nevertheless bear children, the secretion of milk is defective. The influence of this habit on the generative function is indeed so decided that, were it not for fresh arrivals from China and other parts of the East, the population of Singapore would soon be seriously diminished."

Some travellers assert that the habit has no tendency to shorten life. One author says that although the habit of opium smoking is universal throughout China, we find them a powerful, muscular, and athletic people. Another, a physician who resided there for several years, says, "that it will be found in general that the natives do not suffer much from the use of opium."

Instances of long life among opium eaters are not rare, and in most of these cases it has been stated that no impairment of the general health was observed, the persons affected often being robust in appearance. Whether opium has a tendency to shorten life cannot be definitely stated, perhaps future investigation may enable us to form a more definite opinion.

As to the amount of opium consumed by those opium eaters, it has been found that 1 dram per week is not an unusual allowance. Often people become morphin eaters and are known to have this habit only to themselves. They enter upon the usual social or business life of their station without the stimulus of the drug being at all suspected.

The most beneficial and least disastrous results are obtained by always using the smallest possible dose that will produce the desired effect, and increasing this as slowly as possible. The physician should never intrust a hypodermic syringe to the hands of a patient for habitual use, lest the habit of subcutaneous injection be acquired. Many of the so-called "antidotes" for opium are solutions of morphin.

Treatment.—In acute opium poisoning the stomach should be emptied immediately and the patient roused to keep up the respiration. The body surface may be slapped and other stimulation given to produce the capillary circulation, artificial respiration may be resorted to if the patient shows no effort to breathe. Atropin is a valuable stimulant to excite respiration, but its use in opium poisoning has been advised

against by some authors. If it is to be used at all, it should be used as soon as possible.

The action of morphin on the central nervous system is at first that of a stimulant, later followed by depression. The depressing action upon the brain seems to be produced almost immediately after the primary excitation occurs, while the stimulation of the spinal cord persists for a longer time. Morphin exerts but little action upon the heart, the respiratory movements and the accompanying slow oxidation being responsible probably for the decreasing pulse-rate. The blood-pressure is at a high tension, with no dilatation of the capillary and peripheral arteries, thus producing cyanosis.

The **diagnosis** of opium poisoning may be confused with that of other narcotics, but the difference in odor will often assist in forming a correct conclusion.

The **postmortem appearances** after poisoning by opium are congestion of the brain, sometimes accompanied by effusions and moisture upon the membranous surface. The vessels of the brain are often injected and the lungs and other organs congested, while the blood remains fluid.

In one case reported by Medical Examiner Draper, there were the following characteristics: heart normal; spleen, pancreas, stomach, intestines, liver and bladder normal; kidneys dense and opaque, upon section, obscure outlines of elements; chronic nephritis; the vessels of the pia matter and the brain substance injected; many punctate hemorrhages in corpus striatum.

The **various preparations** of opium are the deodorized opium of U. S. P., consisting of 100 grams of powdered opium, containing 13 to 15% of morphin, macerating the same with ether, and adding recently dried sugar of milk in powdered form in quantity sufficient to make 100 grams. Other preparations are opium and ipecac powder (Dover's powder), deodorized tincture of opium, opium pills, tincture of opium and ipecac, camphorated tincture of opium (paregoric), etc.

Properties of Morphin.—Morphin crystallizes in rhombic prisms, which are soluble in about 100 parts of cold water and twice as soluble in boiling water; freely soluble in cold alcohol; almost insoluble in ether; slightly soluble in chloroform; very soluble in amyl alcohol; soluble in dilute acids, forming salts which are easily soluble in both water and alcohol. Some of the chief reactions of morphin are as follows: Iron chlorid added to a crystal of morphin produces a blue color, unless too much iron has been added, in which case a green color is formed. This is an extremely delicate test when the morphin is pure, but the presence of other alkaloids, such as strychnin or organic matter, diminishes its delicacy. Tannic and gallic acids also give a blue color with iron chlorid.

Fröhde's reagent is perhaps the most delicate test for morphin. It produces immediately a beautiful violet-colored solution, which changes soon to a green, then to a reddish-green, later to a yellow, and after twenty-four hours to a bluish-violet. This reagent is prepared by adding to concentrated sulphuric acid, sodium or ammonium molybdate, in the proportion of 0.01 gram of molybdate to each c.c. of sulphuric acid.

Husemann's test is to allow a crystal of morphin to dissolve in a drop of strong sulphuric acid and to remain for twelve to fifteen hours at the room temperature, or for one-half hour at 100° C., or for a moment at 150° C. Then add a small bit of some oxidizing agent, such as nitric acid, potassium nitrate or chlorate, or iron chlorid, when a beautiful blue or reddish violet color is produced, which quickly changes to blood-red, and gradually fades.

Nitric acid reddens morphin or its salts and forms an orange-red solution, which is darkened by an excess of ammonia, later becoming yellow. Cane-sugar and strong sulphuric acid mixed with morphin produces a red color.

Morphin is precipitated from solutions of its salts by phosphomolybdic acid. Morphin is also precipitated from solution by ammonia water, and morphin itself may be obtained crystalline in this way.

Mayer's reagent produces a crystalline precipitate, and potassium iodid produces a precipitate of white, silky needles. Potassium bichromate gives with morphin an amorphous precipitate which gradually becomes crystalline.

Meconic Acid.—The characteristic reactions of this acid may be mentioned as follows: iron chlorid gives a red color which is destroyed by alkalies or nitric acid. Sulphocyanic acid gives a similar red color with iron salts, and this color is discharged by corrosive sublimate which does not change the color of meconic acid.

Meconic acid can be separated from organic mixtures by precipitating with acetate of lead, collecting the precipitate upon filter-paper, suspending the precipitate in water, and after washing decomposing it with hydrogen sulphid. From the filtrate is obtained the meconic acid, which can be identified by the above tests.

Narcotin.—Narcotin usually crystallizes in the form of rhombic prisms. It is almost insoluble in cold water and only slightly soluble in hot; somewhat soluble in cold alcohol, easily soluble in warm alcohol; very soluble in chloroform, somewhat so in acetic ether and benzol. The best test is that recommended by Husemann, which consists in treating a little of the alkaloid with 0.2 of a cubic centimeter of concentrated sulphuric acid; or dissolving it in dilute sulphuric acid, evaporating this solution, when a red residue will remain which becomes violet on the addition of a trace of nitric acid. If the sulphuric acid residue is heated

to 200° C., it becomes violet-red, and this color is not produced below 100° C., which enables us to distinguish narcotin from curarin. Fröhde's reagent gives a green color with narcotin.

The recognition of opium depends upon the isolation and confirmation of one or more of its constituents, the chief ones being morphin and meconic acid, as they occur in larger proportions than the others. Narcotin, also, is an important factor in determining that opium was administered. With the detection of both meconic acid and morphin, we can assume that opium may have been the form in which the drug was administered. If we also detect narcotin, we have confirmatory evidence to this effect; although, of course, the absence of narcotin with the detection of the two others proves that some denarcotized preparation of opium was used, that is not opium nor laudanum.

Many processes have been recommended for the separation of the alkaloids from organic mixtures. The principal ones are those recommended by Stas and by Dragendorff, and as they are applicable to the isolation of all the vegetable and organic poisons, they are given in detail.

Stas' Method of Separation

The method of Stas is as follows: "The method I now propose for detecting the alkaloids in suspected matters is nearly the same as that employed for extracting those bodies from the vegetables which contain them. The only difference consists in the manner of setting them free, and of presenting them to the action of solvents. We know that the alkaloids form acid salts which are equally soluble in water and alcohol; we know also that a solution of these acid salts can be decomposed, so that the base set at liberty remains either momentarily or permanently in solution in the liquid. I have observed that all the solid and fixed alkaloids above enumerated, when maintained in a free state and in solution, in a liquid, can be taken up by ether when this solvent is in sufficient quantity. Thus, to exact an alkaloid from a suspected substance, the only problem to resolve consists in separating, by the aid of simple means, the foreign matters, and then to find a base, which, in rendering the alkaloid free, retains it in solution, in order that the ether may extract it from the liquid. Successive treatment by water and alcohol, of different degrees of concentration, suffice for separating the foreign matters and obtaining in a small bulk a solution in which the alkaloid can be found. The bicarbonates of potash or soda, or these alkalies in a caustic state, are convenient bases for setting the alkaloids at liberty, at the same time keeping them wholly in solution, especially if the alkaloids have been combined with an excess of tartaric or oxalic

acid." To put in practice the principles thus explained, the following method is proposed: "I suppose that we wish to look for an alkaloid in the contents of the stomach or intestines; we commence by adding to these matters twice their weight of pure and very strong alcohol; we add, afterward, according to the quantity and nature of the suspected matter, from 30 to 50 grains (2 to 3 gm.) of tartaric or oxalic acid—in preference, tartaric; we introduce the mixture into a flask and heat it to 160° or 170° F. After it has completely cooled, it is to be filtered, the insoluble residue washed with strong alcohol, and strained, and the filtered liquid evaporated in vacuo, or it may be exposed to a strong current of air at a temperature of not more than 90° Fahrenheit. If, after the volatilization of the alcohol, the residue contains fatty or other insoluble matters, the liquid is to be filtered a second time, and the filtrate and washings of the filter evaporated in the air-pump till nearly dry. If we have no air-pump, it is to be placed under a bell jar, over a glass vessel containing concentrated sulphuric acid or quicklime. We are then to treat the residue with cold anhydrous alcohol, taking care to exhaust the substance thoroughly; we evaporate the alcohol at a low temperature or, better still, in vacuo spontaneously. We now dissolve the acid residue in the smallest possible quantity of water, introduce the solution into a small test-tube, and add, little by little, pure powdered bicarbonate of soda or potash, till a fresh quantity produces no further effervescence of carbonic acid. We then agitate the whole with four or five times its bulk of pure ether and leave it to settle. When the ether swimming on the top is perfectly clear, then decant carefully about 2 cubic centimeters of it into a small glass capsule, and leave it in a very dry place to spontaneous evaporation." If the suspected alkaloid is solid and fixed, there may or may not be a residue containing it. If there is, a solution of caustic potash or soda should be added to the liquid and agitated briskly with ether. "This dissolves the vegetable alkaloid, now free, and remaining in the solution of potash or soda. In either case we exhaust the matter with ether. Whatever be the agent which has set the alkaloid free, whether it be the bicarbonate of soda or potash or caustic soda or potash, it remains by the evaporation of the ether on the side of the capsule as a solid body, but more commonly, a colorless, milky liquid, holding solid matters in suspension. The odor of the substance is animal, disagreeable, but not pungent. It turns red litmus-paper permanently blue."

In this process the removal of foreign matters may be accomplished by acidifying the residue with sulphuric acid, decanting the solution, and drying over sulphuric acid. This residue can then be treated with potassium carbonate, and the alkaloid removed by absolute alcohol.

Dragendorff's Method of Separation

The process recommended by Dragendorff (which is the best for the isolation of organic principles from organic mixtures, such as animal tissues, fluids, etc.) is given below. The principles upon which it depends are the same as in the Stas process. It is given here in order to avoid unnecessary repetition in speaking of the poisons to be considered:

I. Extract with water acidulated with sulphuric acid two or three times at 40°–50° C. for several hours. Strain and filter the united extracts.

II. Evaporate to beginning syrupy consistency, mix the residue with three or four times its volume of alcohol, macerate twenty-four hours at about 30° C., cool and filter. Wash the solid upon the filter with 70 per cent. alcohol.

III. Evaporate off the alcohol, transfer the residue to a flask, cool, and, if necessary, dilute and filter. Shake this aqueous acid fluid with freshly rectified naphtha ("petroleum ether") at the ordinary temperature frequently and vigorously. After the two fluids have separated, decant the naphtha and allow it to evaporate in several watch glasses. The shaking with naphtha should be repeated as long as anything is removed by it. The naphtha removes from the fluid certain impurities (coloring matters, etc.) in addition to the following substances:

Naphtha Residue from the Acid Fluid

1. *Crystalline.*

a. Yellowish and volatilized with difficulty.

(*a*) The crystals dissolve in concentrated sulphuric acid with a pale yellow and, later, brown and greenish-brown color. **Piperin.**

(*b*) The solution in sulphuric acid remains yellow. Potassium cyanid and potassium hydrate color it blood-red on warming. **Picric acid.**

b. Colorless, easily volatile, and with a strong odor. **Camphor and similar substances.**

2. *Amorphous.*

a. Nonvolatile.

(*a*) Concentrated sulphuric acid dissolves it immediately with a violet and, later, a greenish-blue color. **Constituent of the black hellebore.**

(*b*) Concentrated sulphuric acid dissolves it with a yellow color, which gradually changes to a violet-red, and then to a roe-brown. **Constituent of the aconite and a decomposition product of aconitin.**

b. Pale, with a sharp taste, and reddens the skin. **Capsicin.**

3. *Fluid and with a strong odor.* **Ethereal oils, carbolic acid, etc.**

IV. The aqueous solution is next shaken in the same way with benzol. The benzol is decanted into several watch glasses and allowed to evaporate.

Benzol Residue from the Acid Fluid

1. *Crystalline.*

a. Well-formed, colorless crystals.

(*a*) Sulphuric acid dissolves the hair-like crystals colorless. Evaporation with chlorin water leaves a residue which gives the murexid test with ammonia. **Caffein.**

(*b*) Sulphuric acid dissolves the rhombic crystals colorless. Mixed with oil and applied to the skin, the substance blisters. **Cantharidin.**

(*c*) Sulphuric acid dissolves the scaly crystals, at first colorless, slowly changing to red. It does not blister. Warm alcoholic potassium hydrate gives a temporary red color. **Santonin.**

(*d*) Sulphuric acid dissolves the racemose crystals with a yellowish-orange color, and this solution gives a transient violet color with nitric acid. **Caryophyllin.**

(*e*) Sulphuric acid colors the crystals nearly black, and becomes itself colored a beautiful red. **Cubebin.**

b. Crystals pale or clear yellow.

(*a*) **Piperin** (III. 1, a,*a*).

(*b*) **Picric acid** (III. 1, a,*b*).

(*c*) Potassium hydrate = purple color. **Aloetin.**

c. Usually only indistinct colorless crystals.

(*a*) Sulphuric acid = greenish-brown. Bromin colors this solution red, which becomes green again on diluting with water. The substance slows the action of a frog's heart. **Digitalin.**

2. *Amorphous.*

a. Colorless or pale yellow residue.

(*a*) Sulphuric acid gives, at first, a yellow solution, which becomes red later. Fröhde's reagent does not give a violet color. **Elaterin.**

(*b*) Sulphuric acid gives a red solution. Fröhde's reagent a violet-red. Tannin gives no precipitate. **Populin.**

(*c*) Sulphuric acid gives a deep red color. Fröhde's reagent = a beautiful cherry-red. Tannin = yellowish-white precipitate. **Colocynthin.**

(*d*) Sulphuric acid = a beautiful red, often gradual. Tannin = no precipitate. **Constituents of the pimento.**

b. Clear yellow residue.

(*a*) Sulphuric acid = yellow. This solution becomes green, then quickly blue and violet upon the addition of nitric acid. **Colchicin.**

(*b*) Sulphuric acid dissolves it with the separation of the violet powder. Potassium hydrate = red. Sulphid of ammonia = violet and on heating, indigo-blue. **Chrysammic acid.**

c. Greenish, bitter residue. Sulphuric acid = brown. Fröhde's reagent = at first brown, then green, blue-violet, and finally violet, the change of color beginning at the edge. **Constituents of the wormwood, absinthiin.**

V. The acid aqueous fluid is now shaken with chloroform, which is removed with a pipette and allowed to evaporate in watch glasses.

Chloroform Residue from the Acid Fluid

1. *More or less distinctly crystalline.*

a. The solution of the sulphate reacts like an alkaloid with a solution of iodin in iodid of potassium.

(*a*) Sulphuric acid = a colorless solution. Chlorin and ammonia water do not give murexid reaction. **Cinchonin.**

(*b*) Sulphuric acid = colorless solution. Chlorin and ammonia water give the murexid test like caffein. **Theobromin.**

(*c*) Sulphuric acid colorless solution in the cold, but on warming = blue-violet. **Papaverin.**

(*d*) Sulphuric acid = blue in the cold. **Unknown impurities in the commercial papaverin.**

(*e*) Sulphuric acid = at first gray-brown, and in about twenty-four hours blood-red. Iodin water = blue. **Narcein.**

b. It does not react like an alkaloid.

(*a*) Sulphuric acid = beautiful yellow. Mixed with niter, then moistened with sulphuric acid, and finally treated with concentrated sodium hydrate, it assumes a brick-red color. **Picrotoxin.**

(*b*) Sulphuric acid = beautiful red. It produces slowing of a frog's heart. **Helleborein.**

2. *Amorphous.*

a. The solution in acetic acid produces slowing of a frog's heart, or local anesthesia.

aa. Does not produce local anesthesia.

(*a*) Sulphuric acid = reddish brown. Bromin colors this solution beautiful purple, which changes again to green on diluting. Hydrochloric acid = greenish brown. **Digitalein.**

bb. Produces local anesthesia.

(*a*) Sulphuric acid = brown. This solution becomes violet with the absorption of water. **Saponin.**

cc. Sulphuric acid = dirty red. Hydrochloric acid = red-brown in the cold, but on boiling, brown. **Constituents of the hellebore, principally jervin.**

VI. The acid fluid is again shaken with naphtha in order to remove the last traces of chloroform. The naphtha is removed and the fluid is made alkaline with ammonium hydrate.

VII. Shake the ammoniacal fluid with naphtha at the ordinary temperature.

After the separation of the two fluids decant a part of the naphtha into two watch glasses, one of which has been moistened with concentrated hydrochloric acid.

Naphtha Residue from the Ammoniacal Fluid

1. *Crystalline.*

a. Crystals volatilize with difficulty.

aa. Sulphuric acid = colorless.

(*a*) Potassium bichromate = blue, then red, in sulphuric acid solution. **Strychnin.**

(*b*) Potassium bichromate does not give blue color. Chlorin water and ammonia water give thalleioquin reaction. **Quinin.**

b. Sulphuric acid = yellow, gradually changing to a beautiful deep red. **Sabadillin.**

c. The crystals are easily volatile. **Conhydrin.**

2. *Amorphous.*

(*a*) Purest sulphuric acid = almost colorless solution. Sulphuric acid which contains nitric acid = red color which changes to orange. **Brucin.**

(*b*) Sulphuric acid = yellow color which changes to a deep red. **Veratrin.**

(*c*) Sulphuric acid = brown-green. Fröhde's reagent = red color which soon becomes green. **Emetin.**

3. Volatile and with a strong odor.

a. Crystalline residue on watch glass moistened with hydrochloric acid.

aa. Bichlorid of platinum = no precipitate in its solution.

(*a*) The crystals of the hydrochloric acid compound act upon polarized light, and are mostly needle-shaped and prismatic. **Coniin and methylconiin.**

(*b*) Crystals are cubes or tetrahedra. **Alkaloid of the capsicum.**

b. The hydrochloric acid compound is amorphous, or only crystalline after decomposition.

aa. Bichlorid of platinum = precipitate in its dilute aqueous solution.

(*a*) The hydrochloric acid salt treated as quickly as possible with Fröhde's reagent gives, in about two minutes, a deep violet solution which gradually fades. **Lobelin.**

(*b*) The hydrochloric acid salt smells like nicotin. Fröhde's re-

agent = yellowish color, which becomes pale-red after twenty-four hours. **Nicotin.**

bb. Bichlorid of platinum = no precipitate in its dilute solution.

(*a*) Its naphtha solution gives no turbidity with a solution of picric acid in naphtha, but the mixture leaves a crystalline residue after evaporation (mostly triangular plates). **Trimethylamin.**

(*b*) Its naphtha solution treated in the same way gives moss-like crystals. It is colored blue by a solution of calcium hypochlorite, and also by dilute sulphuric acid and potassium bichromate. **Anilin.**

VIII. Shake the ammoniacal fluid with benzol.

Benzol Residue from the Ammoniacal Fluid

1. *Mostly crystalline.*

a. Sulphuric acid = colorless solution which does not become colored either by standing or by the addition of nitric acid.

aa. Dilates the pupil of a cat's eye.

(*a*) Bichlorid of platinum = no precipitate in aqueous solution. The sulphuric acid has a peculiar odor on warming. **Atropin.**

(*b*) Bichlorid of platinum = precipitate when used in exactly the right amount. **Hyoscyamin.**

bb. Does not dilate the pupil.

(*a*) Sulphuric acid solution colored blue by potassium bichromate.

(*aa*) Tetanizes a frog. **Strychnin.**

(*bb*) Slows the respiration in a frog. **Ethyl- and methyl-strychnin.**

(*b*) Sulphuric acid and potassium bichromate do not give blue color.

(*aa*) The dilute sulphuric acid solution fluoresces and gives the thalleioquin reaction. **Quinin.**

(*bb*) The solution does not fluoresce. **Cinchonin.**

b. Sulphuric acid = at first colorless solution, which becomes, on standing, rose-red or bluish-violet, and blood-red or brownish-red on the addition of nitric acid.

(*a*) A solution of dilute sulphuric acid, on heating, gradually becomes deep blood-red, violet when cooled and treated with nitric acid. The dilute sulphuric acid solution gives a precipitate with ammonia. **Narcotin.**

(*b*) The dilute sulphuric acid solution usually becomes blue on heating. An excess of ammonia water = no precipitate in dilute solutions. **Codein.**

c. Sulphuric acid = yellow.

(*a*) The solution remains yellow on standing. **Acolyctin.**

(*b*) It becomes a beautiful red on standing. **Sabadillin.**

d. Sulphuric acid = deep brownish-red immediately. **Thebain.**

2. *Mostly amorphous.*

a. Purest sulphuric acid = colorless or pale red, or yellow.

(*a*) The sulphuric acid solution is immediately colored red by nitric acid, then orange. **Brucin.**

(*b*) The solution gradually becomes brownish-red. Calcium hypochlorite colors it red. It contracts the pupil. **Physostigmin.**

b. Pure sulphuric acid = yellow solution, which later becomes red. (In the case of delphinin more quickly and more of a dark cherry-red.)

(*a*) The hydrochloric acid solution becomes red on heating.

(*aa*) Causes retching in frogs, and in large doses tetanus. **Veratrin.**

(*bb*) Without action on frogs. **Sabatrin.**

(*b*) The hydrochloric acid solution does not become red. **Delphinin.**

c. Pure sulphuric acid = yellow, then reddish-brown, and gradually violet-red.

(*a*) In small doses paralyzes frogs. Dilates pupil of cat's eye. Difficultly soluble in ether. **Nepaline.**

(*b*) Much more feeble physiological action. Does not dilate pupil. Difficultly soluble in ether. **Aconitin.**

(*c*) Very feeble physiological action. Does not dilate pupil. Difficultly soluble in ether. **Napellin.**

d. Sulphuric acid = dark grayish-brown, changing in a few seconds to blood-red. **Alkaloid in the aconitum lycoctonum.**

e. Sulphuric acid = brown-green. Fröhde's reagent = red, changing quickly to a green. **Emetin.**

IX. Shake the ammoniacal solution with chloroform.

Chloroform Residue from the Ammoniacal Fluid

a. Sulphuric acid dissolves it colorless in the cold.

aa. It becomes slightly colored on warming.

(*a*) After cooling, nitric acid = blue-violet. Sesquichlorid of iron = blue. Fröhde's reagent = violet. **Morphin.**

(*b*) Not colored by nitric acid or sesquichlorid of iron. **Cinchonin.**

bb. The solution becomes blue-violet on warming. **Papaverin.**

b. Sulphuric acid = grayish-brown; on standing, blood-red. **Narcein.**

c. Sulphuric acid = blue-violet. **Alkaloid of the celandine.**

X. Shake the ammoniacal fluid with amyl alcohol.

Amyl Alcohol Residue from the Ammoniacal Fluid

a. Sulphuric acid = colorless solution in the cold. **Morphin.**

b. Sulphuric acid = bright yellowish-red color which becomes brownish. Iodin water = deep brown color. The alcoholic solution gelatinizes. **Solanin.**

XI. Evaporate the aqueous fluid with powdered glass, and extract the powdered residue with chloroform.

The residue from the first chloroform extract slows the respiration in a frog; that of the second and third gives a blue color which changes to a permanent red when treated with sulphuric acid and potassium bichromate. Another part of this residue becomes red on heating with dilute sulphuric acid. **Curarin.**

The substances, as obtained by the above process, must then be subjected to the various tests mentioned under each individual poison.

PILOCARPIN

Pilocarpin is an alkaloid obtained from the leaves of Pilocarpus pennatifolius. Pilocarpus jaborandi is also recognized by the British Pharmacopeia.

Its action is a powerful one, increasing salivation and perspiration.

The **symptoms** are first a blushing of the surface, followed by copious perspiration, an increased flow of saliva, lachrymation, secretion of mucus in the nose and bronchi, followed by cardiac depression, weakened pulse and distressed breathing; later there is vomiting and great thirst. Still later the pupils are contracted and the accommodation of the eye is interfered with; prostration, giddiness, a confused mental condition often accompanied by hallucinations, follow. If the poison has been taken by the mouth instead of subcutaneously, the stomach should be emptied mechanically and by mustard and water. Atropin will counteract the effects after the poison has been absorbed, and should be administered subcutaneously in successive doses until dilatation of the pupils appears and the excessive perspiration diminishes.

STRYCHNIN

Strychnin is the chief alkaloid that occurs in several species of Strychnos, such as Strychnos nux vomica and Strychnos ignatii. The seeds contain the largest amount of this alkaloid, but the bark also contains a small quantity. Strychnin is also accompanied by another alkaloid, brucin, which produces similar, though milder, effects than those of strychnin.

Nux vomica and strychnin are among the most common of the substances which produce fatal results, either by accident, suicide, or murder. The extremely bitter taste of strychnin is so very intense that it can hardly be considered that this poison could be given for homicidal purposes without being detected. Certain drinks, such as bitter ale, disguise the taste of strychnin, and as the strychnin solution does not produce irritation, enough may be swallowed to produce death.

The seeds of nux vomica are peculiar, gray to greenish-gray, soft

and hairy, with a silky luster; internally they are more or less horny, somewhat translucent, and very tough. The powdered seeds look not unlike licorice powder, and in a pure state they give a dark orange color with nitric acid. The extracts of nux vomica, both solid and fluid, are widely used in medicine as tonics. In fact, the latter is an almost universal household remedy.

Strychnin is the most active of all the convulsive poisons, being about forty times as powerful as brucin. In man medical doses of $\frac{1}{60}$ to $\frac{1}{10}$ of a grain of strychnin produce the effect of a bitter tonic, increasing the quantity of urine and saliva. Its action upon all vertebrates is practically the same. It may be recovered from the human body, where death has resulted from its action, and in sufficient amount to cause death to a small animal.

The **symptoms** of its toxic action depend upon the quantity of the poison swallowed and upon whether the stomach was full or empty. The first evidence of the absorption of a dangerous dose is increased activity of the senses, such as restlessness, increasing agitation, sensation of itching, exaggerated sensibility to touch, and soon after the appearance of these symptoms there is muscular stiffness accompanied by twitchings and unsteadiness in walking. The muscles of the jaw are usually the last to be attacked.

If the dose is large enough the above symptoms, which soon appear, are followed by severer muscular contractions, and may sometimes cause opisthotonos. The face becomes pale, the speech interrupted and difficult, the jaws firmly locked, with the tongue sometimes between the teeth. At the same time the intellectual faculties are preserved. These various phenomena or convulsions, after a longer or shorter time, produce the characteristic tetanic convulsions; the muscles become rigid and violently throw the limbs into extreme contraction. The plantar surface is turned inward, and the facial muscles produce horrible and anxious countenances. Respiration becomes difficult from rigidity of the thoracic muscles. The neck is swollen; the lips become cyanotic. Later respiration slowly reappears, the lips open, and the victim apparently survives. If the dose is large enough these symptoms reappear. But if recovery is to take place the convulsions return with diminished force, leaving intense muscular fatigue, with increased excitability to reflex action, and often muscular stiffness which may persist for a longer or shorter time. Death takes place from asphyxia caused by the contraction of the thoracic muscles and from exhaustion during the interval after the fourth of these paroxysms. These paroxysms usually last from one to five minutes, and in cases which tend to recover, the paroxysms become less and less severe, and the intervals longer apart, while the reverse is true in those cases where fatal results come soon,

and death takes place in the human adult after the fourth or fifth paroxysm. Children may die even after the first convulsion.

Between the paroxysms the patient is able to converse, but a paroxysm may be caused by any stimulus, such as any sudden noise. The excessively bitter taste, the rapidity of the onset of the symptoms, the rapid progress either to a fatal termination or to recovery, and the limited number of convulsions, with a normal intellect between the paroxysms, are characteristic clinical symptoms of poisoning by nux vomica or strychnin.

Absorption may take place by rectal injection which may produce symptoms very soon after its administration. The most rapid method is by intravenous injection, when symptoms will appear in about one-third of the time required for its absorption by the stomach. Strychnin can be easily detected in the saliva of an animal which has received a subcutaneous dose of this poison if the examination is made within a few minutes, but after the lapse of one-quarter of an hour it may entirely disappear. It can also be detected in the urine by chemical analysis.

Strychnin Convulsions as Compared with Tetanic Convulsions.—It is not always easy to distinguish between the effects of poisoning by strychnin and those produced by tetanus. The most striking symptom is the sudden appearance of the convulsions and the rapidity with which the attacks succeed each other, and the short space of time intervening between the spasms and death in the case of strychnin poisoning. The intervals between the spasms are marked by calmness on the part of the patient, whereas in tetanus the rigidity is generally permanent, and the onset which is more prolonged in poisoning has more the character of a paroxysm rather than a succession of attacks. The fatal result in tetanus never occurs within two or three hours, as it may in strychnin poisoning. In tetanus the duration is generally from two to ten days, and in any case exceeds that of strychnin poisoning. In tetanus some cause for death can almost always be detected, and several hours or even days may elapse after the infection before a severe convulsion occurs. In tetanus the jaw is the first to be affected, while in strychnin poisoning, where there is any difference in the order in which the various muscles are attacked, the jaw is the last, and the number of convulsions in strychnin poisoning is usually limited to four or five, but in tetanus they may be quite numerous.

Strychnin Convulsions as Compared with Puerperal Convulsions.—Rarely does a pregnant woman become the victim of criminal strychnin poisoning. Of course, when such a case does occur, the question arises whether the convulsions are due to pregnancy or to strychnin. When due to the puerperal condition, the number of convulsions is gener-

ally greater than five. In puerperal convulsions there is no recollection as to what occurred either during the convulsion or during the interval. In strychnin poisoning, the intellect is unimpaired, except possibly during the last interval and convulsion. Death usually takes place more quickly after the first convulsion in strychnin poisoning than in eclampsia. When death occurs from eclampsia, it usually does not take place before the birth of the child; whereas in strychnin poisoning this event, of course, makes no difference. In two cases reported death occurred before the birth of the child. In case of death due to puerperal convulsions no strychnin would be detected by chemical analysis.

Lethal Dose.—The minimum quantity of nux vomica which is known to have caused death is said to be 3 grains of the alcoholic extract. Fifteen grains of the powder proved fatal. Several cases have been reported in which 50 or 60 grains have been followed by fatal results. Strychnin has caused death in a dose of 1 grain. Recovery has occurred even after 7 grains were taken. Fifty grains were taken upon an empty stomach and remained in the stomach 50 minutes before it was removed by an emetic and the stomach-pump. The symptoms were slight and the girl recovered. The usual fatal dose is recognized as ½ grain of strychnin or one of its salts. One-fourth of a grain is reported to have caused death in an adult.

Treatment.—The treatment consists in the immediate washing out of the stomach with water, although this may be interfered with on account of the convulsions. Chloroform may be administered in order to combat the convulsions and to effect the passage of the tube. Strangers, draughts of air, noise, and everything which may act as a stimulant and thus produce convulsions, should be guarded against as much as possible. Remedies, therefore, should be administered as quickly as possible. Where the respiratory movements are seriously interfered with, as they may be by the convulsions, and asphyxia supervenes, inhalations of oxygen may be administered.

When strychnin is introduced subcutaneously its action is apparent in a few seconds. Strychnin in pill form will not be as rapidly absorbed as nux vomica, the symptoms not appearing for one-half to two hours.

The **diagnosis** is generally easily made as the symptoms are so characteristic. Most of the conditions accompanied by similar convulsions have already been spoken of.

Postmortem Appearances.—The pathological appearances of strychnin poisoning are not characteristic. The most important physiological lesions are those found in the nerve-centers, but it must be remembered that there are certain diseases which may cause identical changes. The degree of rigor mortis and the permanence of this condition are peculiar to strychnin poisoning. This cadaveric rigidity occurs much

earlier in cases where death has followed the use of convulsive poisons, so that in strychnin poisoning we often meet with this condition. On the other hand, if the convulsions have been prevented by medicines, this postmortem peculiarity may be lacking. In one case it is stated that seven hours after death the rigidity of the body was so great as to allow it to be lifted by the heels; it is described as being "as stiff as wood". Other postmortem changes noticed are signs of inflammation in the intestinal canal; congestion of the brain and its membranes; the right side of the heart is usually contracted and the blood dark and fluid.

Properties.—Strychnin occurs generally in the form of prismatic crystals of the rhombic system when crystallization is slow; but when hastened from the solution, the crystals are needle-shaped. It is soluble in about 7000 parts of cold, and 2500 parts of boiling water; easily soluble in alcohol, benzol, naphtha, and chloroform. Amyl alcohol and chloroform dissolve it the most readily, the latter taking up nearly 20% of its weight; it is only slightly soluble in ether, readily soluble in dilute acids, forming salts which are easily soluble in alcohol and water. When gently heated, strychnin is volatilized unchanged, and can be obtained in the form of a sublimate which has a characteristic crystalline appearance if touched with a drop of water. Strychnin has an exceedingly bitter taste which can be detected in a drop of a solution containing one part in 1000. By some authors it is claimed that it can be detected in even greater dilution. It is the most bitter substance known, and can only be administered criminally when the victim believes that he is taking a very bitter medicine. Strychnin is readily thrown down from its solution in acids by ammonia, generally in crystalline form. Treated with a drop of concentrated sulphuric acid, it forms a colorless solution, across which, if a crystal of potassium bichromate be drawn, there develops a beautiful play of color, first an immediate purple, which changes quickly to violet, then to red, yellow, finally becoming colorless. This test applied to curarin gives the same play of colors, but the red is produced much more quickly, and is more permanent than with strychnin. In place of potassium bichromate, other oxidizing agents, such as potassium permanganate, manganese dioxid, ceroso-ceric oxid, may be used. Strychnin is precipitated by a solution of potassium bichromate, forming an aggregation of yellow needle-shaped crystals. Iodin in potassium iodid gives a brown, amorphous precipitate, which is soluble in boiling alcohol, and separates from it upon cooling in the form of prismatic crystals. Picric acid gives a yellow precipitate, which is amorphous at first, gradually becoming crystalline. Mercuric chlorid and Mayer's reagent give amorphous precipitates, but these readily become crystalline.

Brucin crystallizes in the form of oblique, rhombic prisms, which are

more soluble than strychnin in water and alcohol; it is insoluble in ether, but soluble in chloroform, naphtha, amyl alcohol, benzol, and dilute acids. Alkalies precipitate brucin from its solution, generally amorphous, but becoming crystalline. It is, however, quite soluble in an excess of ammonium hydrate. Strong nitric, and strong sulphuric acid containing a trace of nitric acid impart to brucin a beautiful orange red color, which is changed to a reddish-violet by a solution of stannous chlorid. It has a very bitter taste, though not so bitter as that of strychnin, and is not nearly so active physiologically.

The **isolation** of strychnin and brucin can best be performed by Dragendorff's scheme, both of these alkaloids being removed from the alkaline solution by naphtha, benzol, and chloroform. Benzol removes them better than naphtha, and chloroform better than benzol, leaving both as a crystalline residue after evaporation. Where strychnin and brucin have been detected, it is inferred that nux vomica or one of its pharmaceutical preparations was used. Strychnin withstands decomposition a long time and has been detected a year after death. The physiological test should never be omitted for verification of the presence of strychinin. This is best performed upon a frog by giving him subcutaneously a bit of the strychnin residue in solution.

FIG. 19.—ATROPA BELLADONNA. (Deadly Nightshade.)

TROPIN COMPOUNDS

MYDRIATICS.—Under this heading we include the associated alkaloids atropin, hyoscyamin, and hyoscin, as they have the same characteristic reaction—dilatation of the pupil of the eye.

These alkaloids are, chemically, tropin, in combination with certain tropic acids. Tropin itself is a pyridin compound and tropic acid an aromatic acid, therefore these alkaloids can be saponified. The tropin from atropin is similar to ecgonin which is a nucleus of cocain.

ATROPIN occurs in Atropa belladonna, commonly known as the deadly nightshade. It crystallizes in needles which have a disagreeable taste, which are only slightly soluble in cold water, easily so in boiling water, and easily soluble in chloroform and warm ether, in alcohol and in amyl alcohol.

HOMATROPIN is an artificial alkaloid similar to atropin in many of its actions, but much less poisonous, and is used in ophthalmic practice. It is crystalline, slightly soluble in water, easily so in ether and chloroform.

HYOSCYAMIN is isomeric with atropin from many solvents, such as

benzol and chloroform. It can be obtained in crystalline form, though generally it separates from amyl alcohol as an amorphous body which is only slightly soluble in cold water, easily soluble in hot water, soluble in alcohol, ether, chloroform, and benzol.

Hyoscin used to be considered an isomer of atropin, but is now considered identical with scopolamin. It is an amorphous base, but its salts are generally crystalline. It is only slightly soluble in water, soluble in alcohol, ether, chloroform, and benzol.

Belladonna seeds are small and kidney-shaped, and covered with small, round projections. Besides atropin which exists in the plant in combination with malic acid, there usually occurs hyoscyamin. The younger roots of the wild belladonna contain hyoscyamin only, while the larger roots contain chiefly atropin.

Atropin has caused criminal poisoning in India very often, though in other countries it is very rare.

Symptoms of acute poisoning by atropin are a hot and dry sensation in the mouth and throat, with thirst and difficulty in swallowing, caused by slight paralysis of the muscles of deglutition. Nausea and vomiting may occur where parts of the plant have been swallowed. The pupils become dilated and the vision indistinct, due to paralysis of the ciliary muscles and of the sphincters. The flush on the face is marked, the eyes appear brilliant; the pulse is usually small, thin, and rapid. Dizziness often ensues, accompanied by restlessness and great excitement, even delirum. This delirium is often attended with visual hallucinations, for example, the person may imitate one employed in picking up stones. Drowsiness generally supervenes, but in severe cases convulsions may appear. An erythematous rash similar to that of scarlet fever often appears on the chest and other parts of the body.

Some individuals are so susceptible to the action of atropin that even in small doses the throat symptoms are very prominent, even where a small part of a grain of atropin has been dropped upon the eye in ophthalmic practice.

Symptoms of atropin poisoning may occur when a belladonna plaster is applied to the broken surface of the skin and where it is irritated and inflamed.

The root, leaves, and fruit of belladonna are all poisonous, and the berries have caused cases of accidental poisoning in children. The symptoms are similar to atropin poisoning. One case is reported where a boy of fourteen ate some of the berries. He was attacked with a hot and dry sensation in the throat, impaired vision, and objects appeared double, and seemed to revolve and run backward. His hands and face were flushed and there were occasional flashes of light before his eyes. On endeavoring to walk he stumbled, and felt giddy when he attempted

to raise his head. His parents thought him intoxicated. He was incoherent; frequently counted his money and did not know the silver from the copper. His eyes had a fixed, brilliant, and dazzling gaze, he could neither hear nor speak plainly, and there was great thirst. He caught at imaginary objects in the air; his fingers were in constant motion. His pupils were so widely dilated that there was merely a ring of iris. He could not stand when placed upon his legs. He continued in this state for two days, occasionally being unconscious. Gradually recovered and left the hospital on the sixth day.

DATURA STRAMONIUM contains chiefly hyoscyamin, with small quantities of atropin and scopolamin, and the seeds of datura may be confused

FIG. 20.—HYOSCYAMUS NIGER. (Hyoscyamin and Hyoscin.)

FIG. 21.—DATURA STRAMONIUM. (Atropin and Hyoscyamin.)

with capsicum seeds, but they may easily be distinguished by their taste, those of datura having a bitter taste, while those of capsicum are sharp, pungent, and irritating to the mucous membrane and should be classed with belladonna. Poisoning by this plant is usually accidental and often by the ingestion of berries by children. All parts of the plant are poisonous, but the seeds and leaves are the most frequently used. Often there are three stages of symptoms produced: delirium, sleep, and coma. In some cases only the first is observed. Both in the delirium and sleepy stage the victim is constantly engaged picking at real or imaginary objects. The pulse and temperature may undergo severe changes, although as a rule they are not affected. A rash which is often produced by the ingestion of the leaves or from eating

the berries appears as one of the toxic symptoms, and is very similar to urticaria, but varies in different people to a considerable extent.

The active principles found in stramonium are the same as those found in belladonna. The active principle which used to be called daturin has been proved to be identical with atropin.

Hyoscyamus niger, or henbane, also possesses the alkaloid, hyoscyamin which is practically similar in its action to the alkaloid contained in belladonna. All parts of this plant are poisonous. The root resembles parsley and parsnip roots and has been mistaken for them. Hyoscyamus appears to produce a more decided action upon the brain than does belladonna, especially producing a quieting effect upon the muscular system.

Fig. 22.—Duboisia myoporoides. (Duboisin.)

An alkaloid obtained from Duboisia myoporoides is identical with hyoscyamin, and is called duboisin. Its action in causing the dilatation of the pupil of the eye is much more rapid than that of atropin and is probably less irritating to the surface of the eye.

Lethal Dose.—One-third of a grain by subcutaneous injection has produced fatal results. Though the symptoms of poisoning may appear to be very dangerous, recovery is more apt to take place than death. The amount necessarily fatal to human life is not definitely known, varying with the strength of the preparation.

The **treatment** should be the removal of the contents of the stomach, the administration of tannic acid in dilute solution, the object of this being to precipitate the alkaloid if possible, and this removed by means of the stomach-pump. Pilocarpin is the physiological antidote for atropin. Morphin is an antidote only in the symptomatic sense, and should be used very cautiously.

Postmortem appearances are not characteristic. There is generally redness of the lungs, of the meninges, and of the retina. Also there has been observed in animals hyperemia at the base of the brain, and in the lateral ventricles. Congestion of the retina is especially noticed after slow poisoning.

Detection.—The detection of belladonna depends upon the isolation from the vomitus or the feces of portions of the plant, such as the seeds or leaves, and upon the isolation and identification of atropin in the vomitus or urine during life, or in the tissues and blood immediately after death. Atropin may be identified by the crystalline precipitates which are produced in its salts by a solution of bromin in hydrobromic acid; by picric acid, and by gold trichlorid. One of the most delicate precipitants is Mayer's reagent. Platinum bichlorid and phosphomolybdic acid, mercuric chlorid, iodin, and potassium iodid precipitate it if the solutions are not too dilute. A drop or two of a solution of an atropin salt, exclusive of the chlorid, moistened with a drop of fuming nitric acid, evaporated to dryness in a water-bath, the residue moistened with a few drops of fresh alcoholic potash solution, produces a violet color, changing to dark red, and then disappearing.

The best test is the physiological one which depends upon the readiness with which a solution of atropin introduced into the eye dilates the pupil. Of course, the result should be controlled by examination of the other eye. Where berries have been ingested, the seeds can almost always be detected in the gastric or intestinal contents, and are easily recognized by their shape. The color of the berry is also more or less important, and its presence is further confirmatory evidence when the seeds have been detected. There is a substance having a blue fluorescence present in belladonna, and which exists to the large extent in the berry. This is soluble in acids, from which it can be removed by rendering it alkaline with ammonia, and shaking it with amyl alcohol. From the amyl alcohol it can be removed with acidified water. The method of Dragendorff is usually employed for its isolation from organic mixtures, the atropin being in the ammoniacal benzol extract. Atropin withstands decomposition for a long time after death. The urine is one of the most important sources of elimination of this drug; and even after complete absorption by the stomach, atropin has been detected.

VERATRIN

The white and the black hellebore produces violent irritation of the stomach and bowels, and also severe nervous symptoms, such as convulsions and delirium. The green, or American hellebore is much less active, although it has occasionally produced similar symptoms. Its action upon the nervous system is shown by vertigo, coma, and impaired muscular action. The poisonous action of these plants is due to various active principles, namely, helleborin, helleborein, which are glucosids, and others called veratrum alkaloids. The chief one is veratrin, described in the U. S. P. as "a mixture of alkaloids obtained from the seeds of Asagræa officinalis; a white, or grayish-white, amorphous or semi-

crystalline powder, odorless, but causing intense irritation and sneezing, when even a minute quantity reaches the nasal mucous membrane; having an acrid taste, and leaving a sensation of numbness and tingling on the tongue; permanent in the air".

Helleborin, a glucosid obtained by treating the roots with alcohol, is easily soluble in alcohol and chloroform, difficultly so in water and ether; strong sulphuric acid produces a violet color with it. Helleborein, also extracted from the roots by alcohol, is soluble in water, from which it may be precipitated by tannic acid and by sodium phosphomolybdate; it is only difficultly soluble in absolute alcohol and almost insoluble in ether. Concentrated sulphuric acid produces almost immediately a beautiful red color. It is the most important principle of the drug, from a chemico-legal point of view, since it can be isolated from organic mixtures by Dragendorff's method and identified by the physiological effect which it produces upon animals.

Fig. 23.—Helleborus niger. (Helleborein and Helleborin.)

The **symptoms** are severe nausea, accompanied by pain in the stomach and bowels; vomiting, prostration, a small, slow, and feeble pulse, weak action of the heart, dizziness, dilation of the pupil, coma, sometimes with stertorous breathing. Death is generally due to asphyxia, and usually occurs within twenty-four hours or more; rarely in five or six hours. At present, its use in medicine is restricted to ointments containing veratrin for the local treatment of injury.

Serious symptoms have been exhibited after one dram of the tincture, also by a teaspoonful of the fluid-extract of veratrin viride. Seventy minims of the fluid-extract in two doses has proven fatal to a woman of fifty.

Lethal Dose.—The lethal dose cannot be definitely stated on account of the idiosyncrasy of patients, maximal medicinal dose being $\frac{1}{10}$ grain.

The **postmortem appearances** are not distinctive, though there is generally congestion of the stomach wall and of the intestines, and a passive congestion of the brain and its membranes, as well as of the kidneys.

Veratrin is eliminated to a certain extent by the kidneys, and these organs and any urine that may be obtained should be examined in case of suspected death by this drug.

Properties.—Veratrin is a white, crystalline body, soluble in alcohol, chloroform, benzol, amyl alcohol, and ether; difficultly soluble in naphtha and water, readily soluble in dilute acids, forming salts which are soluble in water. From these salt solutions the alkaloid may be precipitated by alkalies, the precipitate at first being amorphous, gradually becoming crystalline. A minute amount of veratrin brought in contact with the nasal mucous membrane excites violent sneezing. Strong sulphuric acid dissolves veratrin, forming a solution which at first is colored yellow, gradually changing to an orange, then to a red, and later to a carmine-red color which is more or less permanent. Mixed in a little sugar and then treated with sulphuric acid, the mixture is at first yellow, but quickly changes to grass-green, then to a beautiful blue, and later to a dirty violet color. Strong hydrochloric acid dissolves the pure alkaloid without change of color, but if the solution be heated it quickly acquires a red color which ultimately becomes very intense and resembles that of potassium permanganate in solution. Fused zinc chlorid in dilute hydrochloric acid evaporated to dryness with veratrin produces a red color. The physiological test should also be employed in legal cases. Veratrin dissolved in very dilute acetic acid acts very energetically upon frogs in a dose of 0.0004 gram; violent retching is produced quickly, the action of the heart is slowed, the pulsations are diminished from 60 to 32 per minute after the lapse of ten minutes, and to 8 in one-half hour, when the heart's action becomes very irregular and sometimes ceases. Tetanic convulsions are caused by larger doses (0.002).

FIG. 24.—VERATRUM VIRIDE. (False Hellebore.)

Veratrin can be separated from organic mixtures by Dragendorff's scheme. It is removed from the alkaline solution by shaking with naphtha or benzol, preferably the latter, and the residue left after the evaporation of the benzol used for the above tests.

CHAPTER VI.

PTOMAIN POISONING

Ptomains are basic substances containing nitrogen, and are often called putrefactive alkaloids. The term animal alkaloid is erroneous, as they may be formed from vegetables as well as from animals. As a rule, they are the product of bacterial action upon proteids. All ptomains are generally considered poisonous without regard to their origin or nature; some of them are, however, non-poisonous. A few have been isolated. Salkowski and Brieger obtained from mussels a ptomain which they called mytilotoxin. Tyrotoxicon was isolated by Vaughan, and Brieger has isolated certain ptomains which he calls cholin, cadaverin, and putrescin. Faust has isolated sepsin. The character of the ptomains depends upon the kind of material from which it is formed and the nature of the organism present, and to a less extent upon the temperature, moisture, etc. Generally, ptomains are produced in the early stages of decomposition of meat or fish. So that material that is rotten or putrid may be harmless, and other material which has no taste or odor of decomposition may be harmful.

"In 1883–84, there was reported to the Michigan State Board of Health some 300 cases of cheese poisoning. As a rule, the first symptoms appeared within from two to four hours after eating the cheese. In a few the symptoms were delayed from eight to ten hours and were very slight. The attending physician reported that the symptoms varied with the amount of cheese eaten. One physician reported the following symptoms: 'Every one who ate the cheese was taken with vomiting which was at first of a thin, watery, later a more consistent reddish-colored substance. At the same time the patient suffered from diarrhea, with watery stools. Some complained of pain in the region of the stomach. At first the tongue was white, but later it became red and dry; pulse feeble and irregular; countenance pale, with marked cyanosis. One small boy, whose condition seemed very critical, was covered all over the body with bluish spots.' Dryness and constriction of the throat were complained of by all. In a few cases the vomiting and diarrhea were followed by marked nervous prostration, and in some dilatation of the pupils was observed. Notwithstanding the severity of the symptoms, there were no fatal terminations among these cases,

though several deaths from cheese poisoning in other outbreaks have occurred."[1] The same symptoms were observed later in a number of persons who drank some milk, and examination of the milk by Vaughn on the premises where the milk had been kept proved the presence of tyrotoxicon.

In Wilhelmshafen, Germany, in 1885, there occurred an outbreak of poisoning which was attributed to mussels. Similar symptoms to those of poisoning by tyrotoxicon were noticed, with the exception of the diarrhea and abdominal pain. The legs lost their muscular power so that the patient could not stand. Salkowski and Brieger obtained from them a ptomain which they called "mytilotoxin".

The **postmortem appearances** of poisoning by these bodies are generally those of gastro-enteritis.

The term "toxalbumin", suggested by Brieger, designates those non-basic bacterial products which are poisonous. The term is not a good one. At first it was understood to convey the idea that the bodies were albumins and were derived from the decomposition of proteids by the action of bacteria. The term proteid-toxins is perhaps a better one. Poisoning by these bodies can be classed under two headings: those due to toxins that have been produced by certain species of bacteria, mostly anaerobic, in food that was at first wholesome, and, secondly, those cases due to poisoning by toxins that were originally in the food as a result of some disturbed function or disease.

Of the former we have several hundred cases where people were poisoned by the ingestion of sausage meat that had undergone decomposition. The term "botulism" for this form of poisoning is an unfortunate one, for the same kind of poisoning may be caused by other foods than sausage. In fact, the isolation of this poison was accomplished from ham, and not from sausage. The same kind of poisoning may be caused by fish.

The **symptoms** generally occur soon after the ingestion of the poisonous food; that is, generally from twelve to twenty-four hours, although one case is on record where the onset was within one-half hour. The symptoms begin with general discomfort, nausea, vomiting, diarrhea, and abdominal pain, even amounting to colic. Later, the diarrhea is followed by obstinate constipation, and also in a few days nervous symptoms appear, especially dilatation of the pupils, paralysis of accommodation, etc. The mouth is dry and there is often a sense of heat in the throat, with great thirst, which cannot be relieved on account of the inability to swallow. The secretions are diminished; the skin dry and cold; the temperature usually below normal, although it may be increased; exhaustion is extreme. Consciousness is generally preserved,

[1] Vaughan and Novy. "Cellular toxins."

although in some few cases that ended fatally coma preceded death. These symptoms are, of course, varied more or less by the idiosyncrasy of the patient and by the amount of poison consumed. Relapses are very common. The specific bacteria causing these symptoms is the anaerobic bacterium, *Bacillus botulinus*. Different species of proteids also form toxins which have caused fatal poisoning.

The **postmortem appearances** in cases of botulism are not characteristic. There may be marked congestion of the lungs, liver, and kidneys, and the mucous membrane of the stomach may be softened and congested.

Some of the vegetable alkaloids produce symptoms similar to those described above, and a differential diagnosis from poisoning by toxalbumins is not always easy. In poisoning by hemlock, convulsions, collapse, and marked salivation are more likely to occur. With conium, paralysis, first of the lower extremities and later by that of the upper appears. In atropin poisoning the face is flushed and consciousness is lost early in the course of the attack.

Some cases of poisoning have been caused by the ingestion of meat that was not wholesome even when the animal was killed. The poorer classes are naturally reluctant to suffer the loss of an animal by disease, especially if that animal could be used for food, so that they have often anticipated the natural death by slaughtering the animal and then used the meat for food. From the bone-marrow of such an animal Van Ermengem succeeded in isolating a bacillus similar to Gaertner's *Bacillus enteritidis*.

The symptoms of poisoning by this class of bodies are loss of appetite, vomiting, diarrhea, abdominal pain, headache, prostration, fever, and chills, but these may be so severe as to simulate cholera or typhoid fever. Sometimes proper cooking of the food will destroy the poisonous body and render the food harmless. These symptoms are more apt to occur among the poor classes, especially if the food is eaten raw.

Inasmuch as the symptoms may not occur for some time after the ingestion of the poisonous agent, the use of emetics or the stomach-pump for the removal of the substances is useless, as absorption has taken place. Where the onset is rapid, and vomiting and purging have not occurred, they may be induced by gentle means, but it is useless to persist in them if they have occurred of themselves. Expectant or symptomatic treatment must be employed in each individual case, as knowledge of the action is so insufficient at present that no rational treatment can be laid down.

Vegetables have often indirectly been the cause of poisoning. This has been discussed to a certain extent in speaking of ergot, and we may

also mention the poisoning by solanin in potatoes. Many cases of poisoning by the latter have occurred in Germany, due to the presence of an increased amount of solanin which is caused by the growth of two species of bacteria, namely, *bacterium solaniferum noncolorabile*, and *bacterium solaniferum colorabile*.

CHAPTER VII.

BLOOD

The blood is ordinarily considered a liquid called "blood-plasma," in which are suspended the solid portion, namely, the red and white blood-corpuscles, and the so-called blood-plates. We also find the blood granules, but they are as yet of no medico-legal importance. The blood has a slightly alkaline reaction, and the specific gravity varies from 1.058 to 1.062. The amount of blood in the human body is roughly estimated at about $\frac{1}{14}$ of the body-weight. If we allow the blood to flow into a cool jar and do not disturb it, it will separate into three layers—an upper, light yellow layer of plasma, beneath which is a thin layer of white corpuscles, and at the bottom a wider layer consisting of red blood-corpuscles. If the temperature of the plasma is raised above zero, it will cause the plasma to coagulate. On the other hand, if we allow the blood to coagulate as soon as it leaves the body, it becomes solid, forming a "clot," retracting from the walls of the vessels and leaving a clear, amber-colored fluid, which is called the "blood serum." The clot consists of fibrin and blood-corpuscles. A substance called fibrinogen exists in the plasma and in coagulation (by some process not thoroughly understood, but probably due to the action of a ferment) forms the fibrin. The plasma contains several bodies of a proteid nature, which are known as fibrinogen, serum globulin, and serum albumin.

The blood serum differs from the plasma in that it does not contain fibrinogen, but does contain the fibrin ferment. It is more strongly alkaline than the plasma, of a specific gravity of about 1.028, has a faintly yellow color, and contains, in addition to the proteids above mentioned, lecithin, cholesterin, soaps, and sugar. The coloring matter belongs to the luteins or fat coloring matters. The serum and plasma both contain potassium, sodium, calcium, magnesium, chlorin, phosphoric acid, and oxygen, although in different amounts. Of the solid elements existing in the blood, the red cells are by far the most important and, medico-legally, are the only ones with which we have to do. These red cells contain the coloring matter called "hemoglobin," and it is this coloring matter that is of importance in examining blood-stains. The number of these red cells in a cubic centimeter of blood varies in different animals and in different individuals. Normal, healthy males generally have about 5,000,000 of these red cells in each cubic millimeter

of blood. Females have about 4,500,000. The red cells are the heaviest of the solid bodies existing in the blood-plasma or serum and, therefore, sink to the bottom of the vessel. The white cells, called leukocytes, occur in human blood in about the proportion of 1 to 700 of red cells. They are somewhat larger than the red cells, and in disease their number is often increased.

The red cells of the blood of vertebrate animals are generally either circular or oval. In mammalia the corpuscles are without nuclei, while in oviparous animals they contain a nucleus, and it is in this way that we distinguish mammalian blood from that of birds, fishes, or reptiles. The size of the blood-cell varies according to the animal, and also somewhat in the blood of the same animal, although close uniformity exists in most of the red corpuscles of the same animal. The average diameter of the red corpuscles of mammals varies from $\frac{1}{3000}$ to $\frac{1}{6000}$ of an inch. The blood-cells of elephant's blood are the largest, having a diameter of $\frac{1}{2750}$ of an inch, and the smallest are those of the musk-deer, which measure about $\frac{1}{12325}$ of an inch. In the blood of the oviparous animals the nucleus is generally oval in shape, but may be more or less circular. Generally it is of a darker color than the cell itself, slightly irregular in contour, and generally is in the center of the corpuscle. In bird's blood the nucleus is more elongated than the corpuscle itself. The corpuscles of the oviparous animals are much larger than those of the mammals.

The **phenomenon of coagulation** is important in the study of the blood and blood-stains. The time required for complete coagulation varies in different animals and under different circumstances. The time required may differ with the blood from the same animal. Fowl's blood begins to coagulate in one and a half minutes; that of the rabbit and sheep in from one-half to one and a half minutes; that of the dog in from one to three minutes; that of man in from three to four minutes, while that of the horse and ox coagulates in from five to thirteen minutes. Human blood is generally completely coagulated in from nine to ten minutes. The blood of the oviparous animals coagulates more rapidly than that of cold-blooded animals and the coagulum is much larger. Coagulation is favored by gentle heating or by adhering to a rough surface or collecting the blood in thin layers. It is retarded by diminished temperature and may be prevented for a considerable time if the blood is cooled rapidly to zero. It is also hindered when the blood is in contact with oily substances. Coagulation may be prevented by heating the blood rapidly to 56° C. to destroy the action of the ferment.

As most blood coagulates more or less slowly, it is often possible to determine the direction from which the blood came. When blood falls upon a flat surface in an oblique direction, the larger part of the blood is carried to the further side of the spot, and if the force is enough there

may be one or more spatters or minute spots beyond. If the blood is thrown upward upon a vertical surface, the bulk of the blood may be carried to the top of the spot. When coagulation is hindered, the blood will tend to gravitate; but if coagulation is rapid, some spots may be found with the greater portion of the blood at the higher side. Blood dries much more slowly than water, and the nature of the surface upon which the blood falls influences considerably the time of drying. Where the blood falls upon a porous surface, naturally the drying is rapid; but if it falls upon glass or smooth wood, the time of drying is much longer.

The color of the blood or blood-stain varies with its age. At first it is a bright scarlet, but on exposure to light and air it becomes darker, changing to a brown or brownish-red. This change may be hastened by exposure to direct sunlight, by heating the stain, or by the application of alcohol or other preservatives. Therefore, the examination of blood-stains should be made as soon as possible, in order that as much information as possible may be obtained as to how long previously the blood was spilled, the direction from which it came, and its source.

TESTS FOR DETERMINING THE PRESENCE OF BLOOD

The question is whether the stain under examination is a blood-stain or not, and if so, whether it came from a certain kind of animal, which, in medico-legal practice, generally means whether it came from a human subject. We may divide the methods for determining these questions into the chemical, spectroscopical, microscopical, and biological. The chemical and spectroscopical methods are for the purpose of detecting the red coloring matter of the blood, and will determine whether the stain is a blood-stain or not.

The microscopical examination enables us to tell whether the blood is consistent with being human blood or not. The biological test enables us to express an opinion as to whether the blood is human blood or the blood of some other animal.

The chemical tests are concerned with the hemoglobin of the red cells. With oxygen this hemoglobin forms two compounds, oxyhemoglobin and methemoglobin. In oxyhemoglobin the combination is a very loose one, while the latter is quite stable. Oxyhemoglobin solutions have a bright cherry-red color, such as seen in arterial blood. Medico-legally, we examine the hemoglobin or some of its decomposition products, and also the blood serum. The presence of the latter is only confirmatory evidence that the stain is a blood-stain, for there are other substances that contain albumin, which is the basis of this test. Hemoglobin unites with carbon monoxid, carbon dioxid, nitric oxid, forming different chemical compounds called carbon monoxid hemoglobin, carbon dioxid hemoglobin, and nitric oxid hemoglobin. The car-

bon monoxid hemoglobin is important medico-legally in connection with poisoning from carbon monoxid or water gas, but is of little value so far as the investigation of blood-stains is concerned. Hemoglobin heated to 100° C. is decomposed into a body called "globin", which is an albuminous substance and is coagulated at this temperature to a pigment called "hematin." Strong acids or strong alkalies also bring about this decomposition, but there is no coagulation of globin, existing as an acid or alkaline albuminate. Hematin is a brown pigment and plays an important part in the chemical and spectroscopic examinations of the suspected stains. It contains iron, and when it loses this iron it is called hematoporphyrin, in which case the ordinary chemical tests for hematin will fail. They will also fail if heat has been applied to the stain, as in ironing, and by this means the stain may be so fixed that ordinary solvents will not extract it from the fabric. But it can be dissolved by concentrated acids, and for this purpose alcoholic sulphuric acid may be employed, which will yield a solution suitable for spectroscopic examination.

Chemical Tests

The chemical tests are applied to a stain to tell whether or not it contains hemoglobin and, therefore, is a blood-stain. The principal tests are Teichmann's test, the sodium tungstate test, the guaiacum test, and the albumin test.

Teichmann's test is the most important by far. If the suspected stain has dried upon some non-absorbent surface, such as glass, a portion may be removed on the point of a knife, and transferred to a glass slide. If the stain has soaked into the fabric so that a bit cannot be removed by scraping, a few fibers may be isolated, scraped with the point of a knife, and the dust collected upon a glass slide, or a small portion of the fabric may be soaked in a drop of water and this drop can be used for performing the tests. The small bit of blood-clot upon the glass slide or the dust is then treated with a drop of water and a minute crystal of sodium chlorid (common salt) or potassium iodid. The drop is then evaporated to dryness by gently heating the residue covered with a cover-glass, and a drop of glacial acetic acid allowed to run in under the cover-slip. The slide is then gently warmed until bubbles begin to appear under the cover-slip. The slide is then allowed to cool, and may be examined for crystals of the chlorid or iodid of hematin, commonly called "hemin crystals". These hemin crystals occur in characteristic small, rhombic plates, with a yellow or chocolate-brown color, often arranged in crosses and rosettes. If they are present in large numbers the form may vary in some parts of the preparation, some being oval or pointed.

Great care should be taken not to apply too much heat, either in evaporating the first drop or after the addition of the acid. If too much heat is applied the original drop of hematin may be destroyed, and if too much heat is used after the acid has been added the crystals may be carried to the edges of the cover-slip by the boiling. Where various disinfectants have been used upon the material containing the blood-stain or where the spot has been subjected to the direct sunlight or even to intense heat, the hematin is apt to be destroyed and will not yield the crystals.

Sodium tungstate test is often used where the stain has been partially removed by washing or soaking in some fluid. A portion of the fabric containing the stain is soaked in a small vessel containing distilled water and a minute amount of potassium iodid. In this way the remains of the stain may be thoroughly soaked out and put into solution. After soaking for a few hours, the solution is poured off and the fabric again extracted. The extraction is repeated three or four times, and the united extracts are then filtered, the filtrate strongly acidified with acetic acid, and a few cubic centimeters of sodium tungstate, which has previously been strongly acidified with acetic acid, are added. The filtrate is then boiled and forms dense flocculi, which may be chocolate-colored. These are filtered off, washed with water, dried, and tested by the hemin test. A portion may be dissolved in very dilute sodium hydrate and examined by means of the spectroscope for the bands of hematin in alkaline solution. If the precipitate produced by sodium tungstate is slight, it should be allowed to settle completely after boiling, and may be washed in a watch glass, and the residue used for the hemin test.

The guaiac test is performed as follows: A bit of the stain or a few fibers of the stained fabric are placed in a small evaporating dish, and the pigment dissolved out as much as possible in a few drops of water. A few drops of tincture of guaiacum are then added, and the mixture should remain colorless. Then a couple of drops of hydrogen peroxid solution are added, which will produce a bright blue color if traces of the blood pigment are present. According to Wormley, this test will react in a solution of 1 part in 5000. The following substances will give a similar blue color: glue, casein, many compounds of iron, especially chlorid, acetate and, possibly, hydrate. Huenefeld says that iron sulphate, copper sulphate, copper nitrate, chlorid of gold and sodium, manganese dioxid, and potassium permanganate will give this test. At the best, if the test is positive it can only be considered as confirmatory evidence, and other tests must be applied before stating that the stain contains blood pigment. In preparing the tincture of guaiacum, the center of a freshly cut lump only should be used.

The **albumin test** is also only a confirmatory test, as many substances

not containing blood give this test. Ordinarily, this test is performed in the first part of the hemin test; that is, when the solution containing albumin is heated to 65° to 80°; the solution becomes turbid, and there appear small flocculi of coagula on the glass slide.

Spectroscopic Examination

Hemoglobin, or its compounds, or decomposition products give characteristic absorption spectra when examined by the spectroscope. If the amount of blood at our disposal is large, an ordinary spectroscope will do, but where the amount of material is small, as it usually is, a microspectroscope must be employed. The preparation of the stain for spectroscopic examination depends upon whether the blood or blood-stain has undergone decomposition. If it has not, and the amount at hand, is considerable, a portion of the stain can be soaked out in a little water or dilute salt solution, and examined by the spectroscope. When the oxyhemoglobin bands can be recognized, this same solution should then be treated with a little ammonium sulphid or Stokes' reagent, and a single band of hemoglobin obtained. If the stain is only slightly decomposed, we may get a mixture of both the oxyhemoglobin and the hemoglobin spectra. If the stain is decomposed, we shall fail to get any solution of the pigment by treating it with water, and we must add either a little dilute sodium hydrate solution or glacial acetic acid. If we use an alkali we should get a spectrum of hematin in alkaline solution, which can be changed by the addition of a little ammonium sulphid into the spectrum of hemochromogen. If, on the other hand, we use glacial acetic acid, we get a spectrum of hematin in acid solution. If the blood pigment is decomposed into hematoporphyrin, the material should be treated with concentrated sulphuric acid, which will give us the spectrum of hematoporphyrin in acid solution if the stain contains blood pigment. If the amount of material at our disposal is very small, then we must resort to the use of the microspectroscope, and follow the methods suggested by Richardson as the most satisfactory:

"Procure a glass slide with a circular excavation in the middle, called by dealers a "concave center", and moisten it around the edges of the cavity with a small drop of dilute glycerin. Thoroughly clean a thin glass cover about $\frac{1}{8}$ of an inch larger than the excavation; lay it upon white paper, and upon this place the tiniest visible fragment of the freshly dried blood-clot. This fragment will weigh from $\frac{1}{50000}$ to $\frac{1}{250000}$ of a grain. Then, with a cataract needle, deposit on the center of the cover near your blood-spot a drop of glycerin about the size of a small period, and, with a dry needle, gently push the blood to the brink of your microscopic band, so that it may be just moistened by the fluid. Finally, invert your slide upon the thin cover-glass in such a manner

that the glycerined edges of the cavity in the former may adhere to the margins of the latter, and, turning the slide face upward, transfer it to the stage of the microscope. By this method it is obvious that we obtain an extremely minute quantity of strong solution of hemoglobin, whose point of greatest density, generally in the center of the clot, is readily found under a ¼-inch objective, and tested by the adjustment of the spectroscopic eye-piece. After a little practice, it will be found quite possible to modify the bands by the addition of sulphuret of sodium solution, as advised by Preyer.

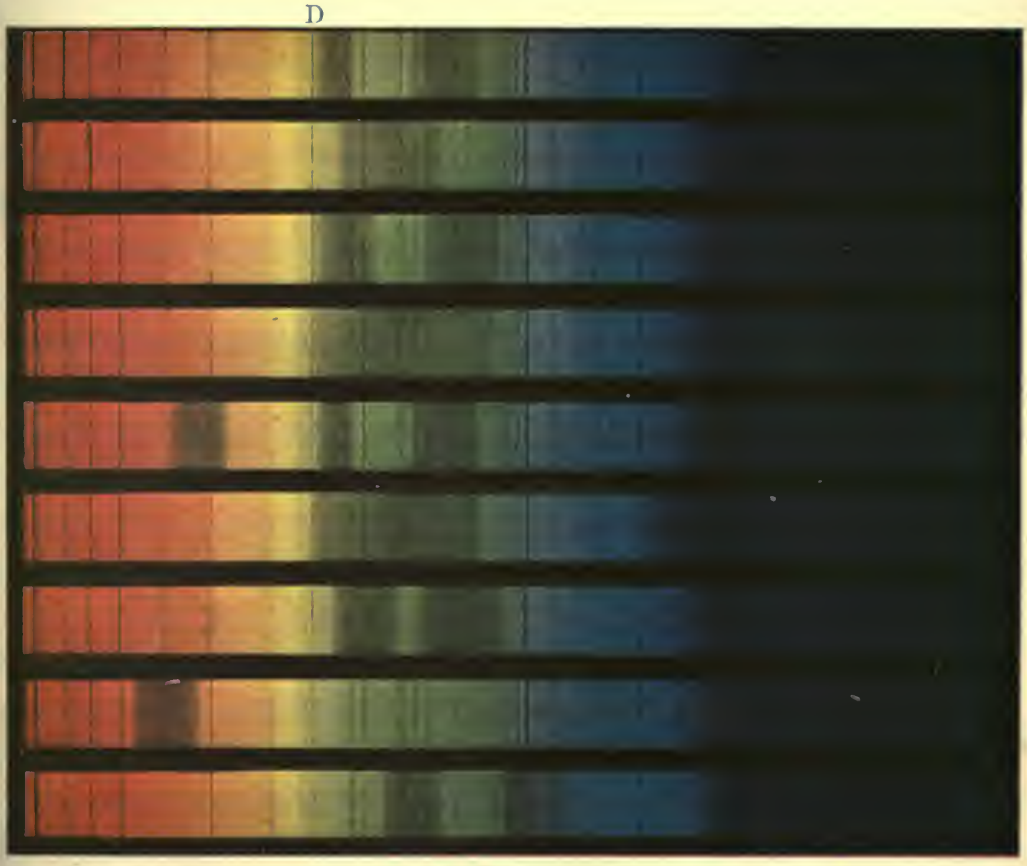
"In cases of this kind, where the greatest possible economy, or even parsimony of the material, is needful, I would advise the following mode of procedure for proving or corroborating your proof of the existence of blood, so that its presence in a stain may be confirmed with absolute certainty:

"From a suspected blood-spot upon metal, wood, paper, muscle, or cloth, scrape with a fine, sharp knife two or three or more minute particles of the reddish substance, causing them to come near the middle of a large, thin, cover-glass. Apply in close proximity to them a very small drop of ¾ per cent. salt solution, bring the particles of supposed blood-clot to its edge, and proceed as I have already directed.

"After thus examining the spectrum of the substance, you may generally, by rotating the stage, cause the colored fluid partly to drain away from the solid portion, wherein, under favorable circumstances, should he specimen be blood, the granular white blood globules become plainly visible, as do also cell walls of the red disks. Among the latter, if your mental and physical visions be keen enough, you can, by the aid of a $\frac{1}{25}$ immersion lens and an eye-piece micrometer, measure a series of corpuscles accurately enough to discriminate human blood from that of an ox, pig, horse, or sheep."

Oxyhemoglobin.—The characteristic spectrum of oxyhemoglobin is best seen in dilute solutions. In concentrated solutions the characteristic band is seen to consist of one broad band extending from D to b. If the solution is dilute the band is resolved into two bands, one lying close to the line D, which is dark colored and more distinct than the other which lies near the line E. On further dilution this band toward E disappears, leaving only the one near D.

There are a few substances whose solutions give a spectrum at all similar to that of oxyhemoglobin. These are solutions of alkanet root in alum and solutions of cochineal. Therefore, the recognition of the spectrum of oxyhemoglobin is not sufficient. The other blood spectra must be obtained by the action of the various reagents which will determine definitely whether the spectrum is that of oxyhemoglobin, as the vegetable solutions are not changed by the action of these reagents.



SPECTRA of 1. Oxyhemoglobin. 2. Hemoglobin. 3. Carbon-monoxid-hemoglobin, from a case of poisoning by illuminating gas. 4. Carbon-monoxid-hemoglobin and hemoglobin; from 3 by treatment with ammonium sulphid. 5. Oxyhemoglobin and methemoglobin from a case of poisoning by potassium chlorate. 6. Hematin in alkaline solution from a case of poisoning by potassium cyanid. 7. The above (6) after treatment with ammonium sulphid. 8. Hematin in acetic acid alcoholic solution. 9. The above (8) after treatment with potassium hydrate and ammonium sulphid.

Hemoglobin.—If the oxygen is removed from oxyhemoglobin, either by exhaustion or by the action of some reducing agent, such as Stokes' reagent, or a dilute solution of sulphid of ammonia, the solution will have a reddish or bluish-red color which is darker than that of oxyhemoglobin, and similar to the color of venous blood. The absorption spectrum of hemoglobin extends from D toward E, occupying most of the space occupied by a strong solution of oxyhemoglobin, but the band is not as dark. Perhaps it is better described as occupying the space between the two bands of a dilute solution of oxyhemoglobin.

Methemoglobin.—This is a compound of hemoglobin with oxygen, but the oxygen is much more firmly combined than in oxyhemoglobin. It is occasionally found in life, in cases of poisoning by potassium chlorate, and in old blood-stains that have been exposed for a long time to the direct action of the sun's rays. Its spectrum shows a band between C and D, and the two bands of oxyhemoglobin between D and E.

Carbon Monoxid Hemoglobin.—This is a more stable compound formed by the union of carbon monoxid with hemoglobin or oxyhemoglobin. It is of legal importance in cases of poisoning by illuminating gas rather than as a test for blood in stains. A solution of carbon monoxid hemoglobin has a very bright red color which is much more persistent than the color of oxyhemoglobin and is much more resistant to reducing agents than oxyhemoglobin. The absorption spectrum is practically identical with that of oxyhemoglobin except that the two bands between D and E are slightly nearer the blue and are not easily replaced by treating the solution with ammonium sulphid as is the case with solutions of oxyhemoglobin.

Hematin.—The spectroscopic examination of hematin is important where the hemoglobin has been decomposed by various agents. To prepare it for spectroscopic examination it is extracted either with a dilute alkali or glacial acetic acid, or an alcoholic solution of sulphuric acid. With the alkali we obtain an alkaline solution of hematin, and with the acid, an acid solution. The alkaline solution has an absorption spectrum consisting of a band between C and D, lying near D, often overlapping it, while the violet end of the spectrum is nearly absorbed. The acid solution has a band between C and D, near the line C. If we use alcoholic sulphuric acid we may get four bands, one between C and D, near C; two bands between D and E, one near D, the other darker, broader, near E; and a fourth between b and F.

Reduced Hematin or Hemochromogen.—An alkaline solution of hematin is reduced by ammonium sulphid. Its spectrum is a well-defined band between D and E, a fainter one between b and F.

Hematoporphyrin.—When blood pigment is dissolved in concentrated sulphuric acid, hematoporphyrin is formed. It can be recognized in the

spectroscope by its spectrum which consists of two bands, a faint one to the left of D, the other between D and E. In alkaline solution, hematoporphyrin has four bands; a faint one between C and D; two between D and E, similar to oxyhemoglobin bands, and a fourth one between b and F.

Microscopic Examination of Blood

For the microscopic examination of dried blood and the measurement of the red blood-corpuscles, it is necessary that the corpuscles be brought into as near the normal shape as possible, and to have them as free as possible from surrounding material, so that they can be focused. For this it is necessary to use some solvent which will soften the blood and allow the corpuscles to separate. The menstrum must be of such a nature that it will not destroy the corpuscles, nor alter their shape. When it is a question of determining whether or not any blood-corpuscles are present, almost any menstrum may be used. The principal ones are the following: Roussin's—glycerin, 3 parts; sulphuric acid, 1 part, and enough water to make the specific gravity of the liquid 1.028. Panini's —water, 300 parts; glycerin, 100 parts; common salt, 2 parts, and mercuric chlorid, 1 part. Richardson's—$\frac{3}{4}$ of 1 per cent. common salt, after previously washing out the coloring matter with dilute salt solution. Virchow's—30 to 33 per cent. solution of potassium hydrate. Wormley uses simply a small quantity of distilled water, approximately the amount originally present in the dried spectrum. If long soaking is required, as in old stains, a dilute solution (sp. gr. 1.030) of glycerin may be used, and if this is not sufficient a little potassium hydrate may be added. Wood recommends the use of a solution of potassium acetate, sp. gr. 1.030, with the addition of a little formalin, to prevent the formation of any fungous growth.

The portion selected for the recovery of the blood-corpuscles should be where the cells have dried quickly, otherwise they are more or less spherical and are unfit for measurement. If the blood is dried in a thin layer upon a nonabsorbent surface, such as glass or wood, a thin film may be scraped from the surface with a sharp knife onto a glass slide, and the cells may be fixed by treating them with a mixture of equal parts of absolute alcohol and ether. A drop of the solvent is then added, and a thin cover-glass placed upon it and sealed so as to prevent evaporation. After a longer or shorter time the mass will become softened, and the red blood-corpuscles may be seen under natural conditions. If the blood is dried upon an absorbent material, such as cloth, much greater difficulty will be encountered. The cells will be found more or less distorted on account of the capillary attraction in the meshes of the material, so that only occasionally can a cell be found

suitable for measurement. If one can find a thin clot or crust, he may detect a sufficient number of corpuscles, whose average diameter may be satisfactory. The finding of such small clots occurs where the blood has formed upon materials which are firm, though slightly absorbent. The longer the clot has been dried, the longer it will be necessary to soak the material. If the fabric has been carefully washed, the evidence of blood-stains may have disappeared, but, as a rule, this occurs only after long soaking and careful rubbing in cold water, so that often, even after attempted removal, a stain may be left behind which can be detected by careful examination. Careful examination must also be made to determine the presence of other substances, such as hair, muscle, etc., as they may possibly throw some light on the source of the blood.

The difference in the blood-cells of the different animals, as to their size and shape and as to whether they contain a nucleus or not, has already been spoken of. The question whether the blood is that of mammalia or that of a bird or fish is easily determined, as the nuclei of bird blood are more resistant than the cell and are easily recognized. The distinction between different kinds of mammalian blood is, however, much more difficult, as it is practically a difference in the size of the red blood-cells. This difference lies between narrow limits, and a positive statement as to the kind of blood is often impossible. In the microscopic examination of the blood-stains one is not ordinarily required to state what kind of blood it is, an expert is required to make a complete investigation and state what his results are, and with what they are consistent.

In very accurate measurements for red blood-cells it is necessary to use the highest powers of the microscope, with a magnification of at least 1000 to 1500 diameters. Each micrometer must be accurately standardized before being used.

In the medico-legal investigation of blood-stains it is generally a question whether the blood-corpuscles are those of a human or those of some domestic animal. The average diameter of the red cells of the most common domestic animals, as well as those of man, lie within the limits of $\frac{1}{3000}$ to $\frac{1}{6000}$ of an inch. The average size of the human red blood cells lies between $\frac{1}{3300}$ and $\frac{1}{3200}$ of an inch. The horse, cow, cat, dog, pig, sheep, and goat are the most common domestic animals whose blood has to be differentiated from that of man. Of these the dog lies nearest the human, the average diameter of a red cell being $\frac{1}{3500}$ of an inch. The following table gives the average measurements as reported by various investigators. The figures given are in common fractions of an inch.

AVERAGE SIZE OF THE RED BLOOD-CELLS.

	Gulliver	Wormley	Formad	Richardson	C. Schmidt, 1848	French Medico-legal Society, 1873	Masson	Dragendorff	Woodard
Man	1-3200	1-3250	1-3200	1-3224	1-3330	1-3257	1-3256	1-3300	1-3092
Monkey	1-3412	1-3382	.....	1-3395	.....	.....	.....	.....	.....
Opossum	1-3557	1-3145	.....	.....	.....	.....	.....	.....	.....
Guinea-pig	1-3538	1-3223	1-3400	.....	.....	.....	1-3300	.....	1-3213
Kangaroo	1-3440	1-3410	.....	.....	.....	.....	.....	.....	.....
Muskrat	1-3550	1-3282	.....	.....	.....	.....	.....	.....	.....
Dog	1-3532	1-3561	1-3580	1-3542	1-3630	1-3479	1-3577	1-3628	1-3246
Rabbit	1-3607	1-3653	1-3662	.....	1-3968	1-3681	1-3628	1-3968	.....
Rat	1-3754	1-3652	.....	.....	1-3968	.....	.....	.....	.....
Mouse	1-3814	1-3743	.....	.....	1-4166	.....	.....	.....	.....
Pig	1-4230	1-4268	1-4250	1-4230	1-4098	1-4233	1-4098	1-4098	.....
Ox	1-4267	1-4219	1-4200	1-4267	1-4385	1-4535	1-4233	1-4385	.....
Horse	1-4600	1-4243	1-4310	.....	1-4456	1-4535	.....	.....	.....
Cat	1-4404	1-4372	.....	.....	1-4535	1-3907	1-4456	1-4535	.....
Sheep	1-5300	1-4912	1-5000	1-5300	1-5649	1-5080	.....	1-5649	.....
Elk	1-3938	1-4384	.....	.....	.....	.....	.....	.....	.....
Buffalo	1-4586	1-4351	.....	.....	.....	.....	.....	.....	.....
Wolf (prairie)	1-3600	1-3422	1-3450	.....	.....	.....	.....	.....	.....
Bear (black)	1-3693	1-3656	.....	.....	.....	.....	.....	.....	.....
Hyena	1-3735	1-3644	.....	.....	.....	.....	.....	.....	.....
Squirrel (red)	1-4000	1-4140	.....	.....	.....	.....	.....	.....	.....
Raccoon	1-3950	1-4084	.....	.....	.....	.....	.....	.....	.....
Elephant	1-2745	1-2738	.....	.....	.....	.....	.....	.....	.....
Leopard	1-4319	1-4390	.....	.....	.....	.....	.....	.....	.....
Hippopotamus	1-3429	1-3560	.....	.....	.....	.....	.....	.....	.....
Rhinocerus	1-3765	1-3649	.....	.....	.....	.....	.....	.....	.....
Whale	1-3099	.....	.....	1-3090	.....	.....	.....	.....	.....
Tapir	1-4000	1-4175	.....	.....	.....	.....	.....	.....	.....
Lion	1-4322	1-4143	.....	.....	.....	.....	.....	.....	.....
Ocelot	1-4220	1-3885	.....	.....	.....	.....	.....	.....	.....
Mule	.....	1-3760	.....	.....	.....	.....	.....	.....	.....

AVERAGE SIZE OF THE RED BLOOD-CELLS.—*Continued.*

	Gulliver	Wormley	Formad
Ass	1-4000	1-3620	.....
Ground squirrel	.....	1-4200	.....
Bat	1-4175	1-3966	.....
Ibex	.....	1-6445	.....
Goat	1-6366	1-6189	1-6100
Platypus (duck-billed)	1-3000	.....	.....
Sloth	1-2865	.....	.....
Capybara	1-3190	1-3164	.....
Seal	1-3281	.....	.....
Woodchuck	1-3484	.....	.....
Musk-deer	1-12325	.....	.....
Beaver	1-3325	.....	.....
Porcupine	1-3369	.....	.....
Llama (long diam.)	1-3361	1-3201	.....
(short diam.)	1-6229	1-6408	.....
Camel (long diam.)	1-3123	1-3331	.....
(short diam.)	1-5876	1-5280	.....
Birds.			
Chicken (long diam.)	1-2102	1-2080	.....
(short diam.)	1-3436	1-3483	.....
Turkey (long diam.)	1-2045	1-1894	.....
(short diam.)	1-3598	1-3444	.....
Duck (long diam.)	1-1937	1-1955	.....
(short diam.)	1-3424	1-3504	.....
Pigeon (long diam.)	1-1973	1-1892	.....
(short diam.)	1-3643	1-3804	.....
Goose (long diam.)	1-1836	.....	.....
(short diam.)	1-3839	.....	.....
Quail (long diam.)	1-2347	.....	.....
(short diam.)	1-3470	.....	.....
Dove (long diam.)	1-2005	.....	.....
(short diam.)	1-3369	.....	.....
Sparrow (long diam.)	1-2140	.....	.....
(short diam.)	1-3500	.....	.....
Owl (long diam.)	1-1763	.....	.....
(short diam.)	1-4076	.....	.....
Reptiles.			
Tortoise (land) (long diam.)	1-1252	1-1250	.....
(land) (short diam.)	1-2216	1-2200	.....
Turtle (green) (long diam.)	1-1231	.....	.....
(green) (short diam.)	1-1882	.....	.....
Boa constrictor (long diam.)	1-1440	1-1245	.....
(short diam.)	1-2400	1-2538	.....
Viper (long diam.)	1-1274	.....	.....
(short diam.)	1-1800	.....	.....
Lizard (long diam.)	1-1555	.....	.....
(short diam.)	1-2743	.....	.....

AVERAGE SIZE OF THE RED BLOOD-CELLS.—*Continued.*

	Gulliver	Wormley	Formad
Batrachians.			
Frog (long diam.)	1-1108	1-1089	.....
(short diam.)	1-1821	1-1801	.....
Toad (long diam.)	1-1043	.....	.....
(short diam.)	1-2000	.....	.....
Triton (long diam.)	1-848	.....	.....
(short diam.)	1-1280	.....	.....
Proteus (long diam.)	1-400	.....	.....
(short diam.)	1-727	.....	.....
Amphiuma tridactylum (long diam.)	1-363	1-358	.....
(short diam.)	1-615	1-622	.....
Fishes.			
Trout (long diam.)	1-1524	.....	.....
(short diam.)	1-2460	.....	.....
Perch (long diam.)	1-2099	.....	.....
(short diam.)	1-2824	.....	.....
Pike (long diam.)	1-2000	.....	.....
(short diam.)	1-3555	.....	.....
Eel (long diam.)	1-1745	.....	.....
(short diam.)	1-2842	.....	.....
Lamprey (circular)	1-2134	.....	.....
(diam. of nucleus)	1-6400	.....	.....

Biological Test for Blood

During the past decade the study of immunity in various diseases has received marked attention. The study of the blood and blood-serum has demonstrated the presence of various specific toxins and certain other bodies called "precipitins". Without going into details of the results of these various experiments, we will confine ourselves to the question in its importance in legal medicine, especially in the examination of blood-stains.

If we inject into a rabbit, either into the peritoneum or subcutaneously or intravenously, the blood serum of another species of animal, the serum of this rabbit will produce a precipitate, when mixed with the serum of the animal whose serum was injected into the rabbit. Several species of animals will react to this test besides the rabbit, but on the whole, rabbits are best suited for this kind of work. For purposes of medico-legal examinations of stains, namely, to determine whether or not the blood may or may not be human blood, 10 cubic centimeters of human serum are injected into the rabbit at intervals of two or three days, and after a few injections, varying from four to ten, allowed to rest for a few days. Rabbits show a great variation in their suscepti-

bility to the injection. Some thrive on the treatment; others are easily made sick and die. Further, the animals vary a great deal in the amount of precipitin contained in their sera. Some produce a strong reaction, others only a weak one, and occasionally one is met with which does not seem to react after numerous injections. Of course. the injection must be done under strict asepsis, and the serum that is used must be sterile. If the rabbit develops an abscess it is better to use another rabbit rather than keep on hoping that the animal will recover from the abscess. Any pleuritic effusion or exudate or hydrocele fluid even may be used, but the blood serum itself is the best. After the animal has received a certain number of injections, the rabbit's serum can easily be tested as to its efficiency by withdrawing a little blood from the central vein at the base of the ear.

If found that it produces a reaction of precipitin, as described later, the animal can either be etherized and bled from the carotid arteries or, if it is desired to save the animal, it can be bled from the central vein at the base of the ear. Once the serum of the rabbit is active it can be kept so by the occasional (once or twice a week) injection of human serum. The blood, after being withdrawn, is allowed to coagulate, and, if necessary, centrifugalized, in order to obtain the serum as clear as possible. By this latter means the serum can often be obtained perfectly clear and almost colorless.

Method of Examination.—If we desire to examine fresh blood, it can be diluted with 100 parts of normal salt solution and, if necessary, allowed to settle, so that the solution is absolutely clear. If a stain is to be tested and it has not been absorbed by the material, a few bits of the cloth can be scraped onto a slide or into a small test-tube, treated with a few drops of water and allowed to dissolve. If the stain has soaked into the fabric so that it is firmly imbedded in the meshes of the material, a few shreds can be soaked out in a few drops of sterile water. In either case the material should be diluted in salt solution. The degree of dilution is not of so much importance as is the degree of dilution of the rabbit's serum. A dilution of 1 part in 100 of the fluid to be tested seems to be the most favorable for the reaction. The dilution of rabbit's serum is of much more importance, as it is upon this dilution that the most accurate results are to be obtained.

Positive reactions have often been obtained with humanized rabbit serum and the sera of lower animals when the rabbit serum was used in too strong solution. It has happened that when the rabbit serum is used in the proportion of 1 part in 10 or 1 part in 20 of blood solution, precipitates have been formed which might be considered as positive. On the other hand, humanized rabbit serum used in the proportion of 1 to 10 or 1 to 20 of solution of human blood has given no precipitate,

while if the rabbit serum was used diluted 1 to 50, or even 1 to 100, a positive reaction was obtained in the same blood. A dilution of 1 of the test serum to 100 of the blood solution will be found to give the most accurate results. If the amount to be tested is small, it may, perhaps, occasionally be better to use a solution of 1 to 50. The second point that is of importance is the length of time that is to be allowed the precipitate to form. In using a dilution of 1 to 100, it often happens that the precipitate does not occur for an hour and a half or two hours; and where the material available for the test has been small and old, even this length of time is not sufficient, and it may be necessary to allow as much as six or twelve hours at a temperature of 37° C. In dealing with small stains, and especially with old ones, the results must be interpreted according to the experience of the investigator, and at best can only be expressed as an opinion.

A detailed account of this test and its application to medico-legal practice will be found in the resumé of Ewing and also in the recent work of Nuttall.[1]

SUMMARY.

We may, therefore, say that under favorable circumstances it can always be determined whether the blood is mammalian or oviparous; it is often possible to distinguish between stains caused by human blood and those caused by the blood of domestic animals: that, if the blood is mammalian blood, and the cells have an average diameter of $\frac{1}{3300}$ to $\frac{1}{3100}$ of an inch, that the blood is not that of a cat, goat, sheep, horse, ox, or goat, that it may be the blood of a dog, guinea-pig, rabbit, or man. If the cells have a diameter of $\frac{1}{3200}$ of an inch, slightly more or less, then these measurements are consistent with the blood being human blood; and finally, if the biological test, under favorable conditions and properly performed by a recognized competent man, gives the characteristic reactions, then the blood may be said to be human blood.

Graham-Smith and Sanger, referring to the biological test, say: "These experiments have led us to the conclusion that, with sufficient material and due precaution to exclude the various sources of error, there are but few conditions met with in forensic practice under which human could not be readily differentiated from other bloods. By this, however, we do not mean to imply that a considerable acquaintance with the action of precipitating antisera on blood solutions is not necessary in the successful application of this test."

Nuttall, in speaking of the use of this test in forensic questions, says: "That this conclusion is fully justified is proved by the official recogni-

[1] Nuttall. "Blood Immunity and Blood Relationship."

tion of the precipitin method in forensic practice in foreign governments. Prof. Uhlenhuth informs me that the method has been recommended by the Ministers of Justice in Germany and Austria, and that it has been officially recognized by the governments of Egypt and Roumania."

The late Prof. E. S. Wood used it in testifying in the Greenleaf case in New Hampshire and in the Blondin case in Massachusetts. It has also been used in a case in New Jersey and elsewhere.

Stains Containing Blood in Various Discharges

It is often possible to determine the source of blood when it has not come from a wound or from a blood-vessel; but this can only be determined by finding, associated with the blood, other formed elements, such as epithelial cells, mucus, spermatozoa, pus, etc.

In cases of nasal hemorrhage the source of the blood can be determined by the recognition of the cylindrical or ciliated epithelium from the mucous membrane and of dried mucus mixed with the blood. Often the hemorrhage is so severe that the stain consists entirely of blood without mucus or epithelium. Of course, where we find mucus and cells we can express an opinion that the blood is consistent with having come from the nose. But we are not justified by finding an absence of mucus or cells to say that the hemorrhage may not have been from the nose. The position and other characteristics of the stain may help us in forming an opinion and enable us to decide whether or not the blood was of nasal origin. If the blood was caused by forced expiration through the nose, the stain is apt to be pale and large, as the amount of mucus is considerable, and when dried we have a very different appearance from ordinary blood-stains.

Generally speaking, menstrual blood will be found to have numerous vaginal cells mixed with it, especially if the blood that is examined was that at the beginning or end of a period. When the hemorrhage is severe we may not be able to find any cells at all, but as with nasal stains, we are not justified in saying that the blood was not of menstrual origin if we fail to find vaginal cells mixed with it. The location of the stain may be of importance in helping to recognize it as being of menstrual or lochial origin. The cells from the vagina are large, polygonal, squamous epithelial cells, similar to those of the mouth and often arranged in small clumps. If there was coexistent with the menstrual flow a discharge of gonorrheal or leukorrheal origin, then the blood and cells will be found mixed with pus. Rarely a ciliated cell from the lining membrane of the uterus may be found mixed with the blood of menstrual origin.

CHAPTER VIII.

SEMINAL STAINS

As a rule, examination of seminal stains does not include the large variety of articles that examination for blood-stains does. The common articles submitted for examination are bedclothes and underclothes; occasionally other articles of wearing apparel; less often bits of wood or leaves, and occasionally scrapings from the skin or genitals of the victim. The stains may exist as dried masses of seminal fluid, or of this mixed with other fluids, such as blood or discharges from the vagina.

The seminal fluid itself varies according to circumstances. Its specific gravity varies from 1.027 to 1.037. It has a slightly alkaline reaction, is more or less viscid, with an opalescent appearance, sometimes grayish, occasionally yellowish, or even reddish. It has a peculiar odor which may be considered more or less diagnostic. When such a stain has dried upon a non-absorbent surface, it forms a scale, more or less grayish in color, which can be easily removed by the point of a knife. If the material is absorbent, it may be very difficult to see the stain at all. It will have a more or less irregular contour and a peculiar feel which is more or less stiff, similar to that caused by blood or other albuminous fluids. It may often be seen by holding it against transmitted light, when it will appear more or less translucent. In cases of rape it is more apt to be found on the posterior portion of the victim's garments or upon the anterior part of the assailant's clothing. A body called "spermin", which gives the general reaction of alkaloids, has been isolated from this fluid.

Florence has isolated from the seminal fluid of man an alkaloidal substance which he claims can be obtained only from human seminal fluid. This body, which he calls "virispermin", gives characteristic crystals with a concentrated solution of iodin in potassium iodid. The test is extremely delicate. Other investigators have claimed that any tissue containing cholin will yield the same crystals.

Florence's test is as follows: The reagent is potassium iodid, 1.65 gms.; iodin, 2.54 gms., and water, 30 c.c. A small bit of the clothing or material containing the stain is cut away with scissors and deposited upon a glass slide. A drop of water is then added and the stain allowed to soak for a few minutes. A drop of the above reagent is then placed upon the glass slide near the first drop, and the two drops are allowed

to mix and are immediately covered with a cover slip. The appearance of the crystals is almost immediate if the stain contains seminal fluid.

For the absolute determination that the suspected stain is a seminal stain it is necessary to obtain the spermatozoa. Although the Florence test is a good preliminary test, still it is not conclusive. Spermatozoa are bodies with an oval head about $\frac{1}{3000}$ of an inch in length and a tail about ten times as long. The head is less dense in its first third than it is in its posterior two-thirds. Spermatozoa are fairly stable and resist decomposition, but when dry they are very fragile and the head is easily broken from the tail. The recognition, especially in an old stain, is often difficult.

In staining slides Florence sometimes uses crocein, and Whitney has suggested methyl green. In the preparation of this stain for microscopic examination, a small bit of the cloth containing the stain is soaked in distilled water on a glass slide, and then carefully teased apart with a needle, covered with a cover-glass, stained or not, as preferred, and then examined with the microscope. If clothing which is absorbent is to be examined, the Florence reaction may often be obtained from any portion of the stain, but the spermatozoa will be found, as a rule, only in the middle portion.

Farnum has suggested that the biological test similar to that described under Blood be employed in the examination of suspected seminal stains. Instead of blood, he uses 5 to 10 c.c. of semen at intervals of three or four days until the rabbit has received five to eight injections. He has found the test specific for human semen when human semen was used for injection. According to him, blood serum does not give a positive reaction.

PART III.

EXTRACTS FROM VARIOUS STATE LAWS AFFECTING THE PRACTICE OF MEDICINE

From laws published and in effect revised to January 1, 1909.

No. 63.] MEDICAL PRACTICE ACT OF ALABAMA. [H. 117.

An Act to Prescribe the Branches of Medical Learning upon which Applicants for the Privilege of Treating Diseases of Human Beings in this State Must Be Examined, and to Provide for the Issuance of Certificates of Qualification therefor.

SECTION 1.—*Be it enacted by the Legislature of Alabama*, That any applicant for a certificate of qualification to treat diseases of human beings by any system of treatment whatsoever shall, according to rules prescribed and standards established by the Medical Association of the State of Alabama, be examined by one of the authorized boards of medical examiners of this State in the following branches of medical learning, to wit: Chemistry; anatomy; physiology; the etiology, pathology, symptomatology, and diagnosis of diseases, obstetrics and obstetrical operations; gynecology; minor and major surgery; physical diagnosis; diseases of the eye, ear, nose and throat; hygiene; and medical jurisprudence; and should said applicant be found proficient in said branches of medical learning a certificate of qualification in such form as shall be prescribed by the said Medical Association of the State of Alabama shall be issued to him, which shall entitle him to treat any and all diseases of human beings in this State in any manner that he may deem best.

SECTION 2.—*Be it further enacted*, That when an applicant states in writing that he has neither studied nor proposes to practice major surgery, said applicant shall be exempt from examination in said branch on major surgery, and should he be found proficient in the other branches of medical learning named in section one of this act, a certificate of qualification in form to be likewise prescribed by the Medical Association of the State of Alabama shall be issued to him, which shall entitle him to treat all diseases of human beings as he may deem best, except by the practice of major surgery.

SECTION 3.—*Be it further enacted*, That all laws and parts of laws, in so far as they conflict with the provisions of this act be and the same are hereby repealed.

Approved February 26, 1903.

FROM THE CRIMINAL CODE.

Practicing Medicine or Surgery without a Certificate of Qualification.

SECTION 5333.—Any person who practices medicine or surgery without first having obtained a certificate of qualification from one of the authorized boards of medical examiners of this State must, on conviction, be fined not less than twenty-five, nor more than one hundred dollars.

ARIZONA

An Act to Regulate the Practice of Medicine.

Be it enacted by the Legislative Assembly of the Territory of Arizona:

SECTION 1.—That it shall be unlawful for any person to practice medicine within the Territory of Arizona until he or she shall have obtained a license therefor, as hereinafter in this Act prescribed.

SEC. 2.—No person shall receive a license to practice medicine within the Territory unless he or she shall have:

First, Obtained a diploma to practice medicine or some department thereof regularly issued by a medical college lawfully organized under the laws of the State or Territory wherein such college shall have been located at the time of the issuance of such diploma; and,

Second, Obtained a certificate entitling him or her to practice medicine as prescribed in Section 4, Chapter 1 of Title 53, being paragraph 3529 of the Revised Statutes of Arizona, 1901, or shall have passed a satisfactory examination prescribed by the provisions of an Act of the Legislative Assembly of Arizona, entitled, "An Act to amend an Act to regulate the practice of medicine in the Territory of Arizona" approved March 18, 1897; or,

Third, Practiced medicine within the Territory of Arizona continuously for five successive years preceding the date fixed for the taking effect of this Act, or,

Fourth, Upon examination by the Board of Medical Examiners of Arizona, shown to the satisfaction of the Board that he or she possesses sufficient knowledge and skill to properly practice medicine; and,

Fifth, Become a bona fide resident of Arizona, and shall have passed the age of twenty-one years and shall have a good moral character.

SEC. 3.—There shall be and there is hereby established in Arizona, a board to be known as the "Board of Medical Examiners of Arizona." Said board shall consist of five members, who shall be nominated and, by and with the consent of the Legislative Council, appointed by the Governor. Such members shall, at the time of their appointment, be each a bona fide citizen of the United States, and have been a resident of the Territory of Arizona for at least three consecutive years continuously next preceding the time of his appointment; and at the time of his appointment shall be and shall have been for at least three consecutive years theretofore actually engaged in the practice of medicine in the Territory of Arizona. . . . .

SEC. 4.—Any person desiring to obtain a license to practice medicine within this Territory shall make application therefor to the Board of Medical Examiners of Arizona. The application shall be in writing and state the name of the applicant, his age, his residence, the name and

location of the college whence his diploma issued, the length of time, if at all, he has practiced medicine, and where, giving specifically the places where he has practiced medicine, and the dates between which he practiced at each place, and the particular school and department of medicine he practiced, and contain such other information as may be prescribed by the rules and regulations of the Board. Each application for license shall be verified by the oath of the applicant, taken before some officer authorized by the laws of Arizona to administer oaths. The application shall be accompanied by the diploma of the applicant, or by a copy thereof, authenticated to the satisfaction of the Board. The applicant shall also present with his or her application the affidavits of at least three or more residents of the county and State wherein the applicant formerly resided and practiced medicine, stating within their own knowledge, the name of the applicant, the length of time they have known him or her, his or her residence, the length of time he or she has resided there, and, if applicant shall have practiced medicine in Arizona, the length of time and place or places where he or she has so practiced, and that the applicant is of good moral character. If the applicant shall have received a certificate under the provisions of Paragraph 3529, Revised Statutes of Arizona, 1901, or shall have passed a satisfactory examination prescribed by an Act of the Legislative Assembly of the Territory of Arizona, entitled, "An Act to amend an Act to regulate the practice of medicine in Arizona," approved March 18, 1897; or, if the applicant shall have practiced medicine within the Territory of Arizona continuously for five successive years next preceding the date fixed for the taking effect of this Act, he or she shall present with his or her application proper and satisfactory evidence thereof; the applicant shall at the time of the presentation of his or her application for a license to practice medicine, pay to the secretary of the Board of Medical Examiners the sum of two ($2) dollars. If it shall appear that the applicant has not obtained the certificate mentioned in paragraph 3529, Revised Statutes of Arizona, 1901, or passed the satisfactory examination prescribed by the provisions of an Act of the Legislative Assembly of Arizona entitled, "An Act to amend an Act to regulate the practice of medicine in Arizona," approved March 18, 1897, and shall not have practiced medicine within this Territory continuously for five years next preceding the date fixed for the taking effect of this act, then no license shall issue to him or her, until he or she shall have, upon examination by the Board, shown to the satisfaction of the Board that the applicant possesses sufficient knowledge and skill to properly practice medicine.

SEC. 5.—The examination provided for in the preceding section shall be made by said Board as soon after the application shall have been presented as it may be conveniently done, and after notice to the applicant of the time and place thereof. The examination shall be conducted under such reasonable rules and regulations as the Board may prescribe therefor, and with the design and purpose of ascertaining the fitness of the applicant for the practice of medicine in this Territory.

If the applicant request it he or she shall have the privilege of being examined in the branches of the science and the practice of medicine other than Physiology, Anatomy, Pathology, Chemistry, Practice, Surgery, Obstetrics and Gynecology, by the member or members of the Board, if there be any, of the particular school of medicine specified in his or her diploma, and if the examination in such other branches be satisfactory to the members or member conducting said examination, it shall be approved by the Board and to the extent thereof be deemed to be to the Board's satisfaction. Before any examination the applicant shall pay to the secretary of the Board, in addition to the fee hereinbefore required the further fee of ten ($10.00) dollars.

Sec. 6.—When it shall be made to appear to the satisfaction of the Board that the applicant possesses the qualifications in this Act prescribed to fit him or her to practice medicine in this Territory, and that he or she has complied with the provisions of this Act, a license shall thereupon issue to the applicant. The license shall be signed by the President and countersigned by the Secretary of the Board, and have impressed upon it the seal adopted by the Board. It shall recite that the person therein named has complied with the provisions of this Act, and that he or she is entitled to practice medicine in the Territory of Arizona, and shall be in such form as the Board may adopt.

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Sec. 11.—The provisions of this Act shall not be construed to modify or in any wise to affect the provisions of the laws of this Territory relating to the practice of dentistry.

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Sec. 14.—This Act shall be in force and effect from the date of its approval by the Governor; provided, however, that persons having already complied with previous laws regulating the practice of medicine in the Territory of Arizona shall have until the first day of June, 1903, within which to file their applications for license and procure same, and until such time no penalty shall be imposed upon such lawful practitioners for a violation of the provisions of this Act.

Approved March 19, 1903.

ARKANSAS

An Act to Regulate the Practice of Medicine and Surgery, and Providing for the Appointment of Three Boards of State Medical Examiners, and Defining Their Duties.

Be it enacted by the General Assembly of the State of Arkansas:

SECTION 1.—That the medical examiners herein provided for shall consist of three Boards: One of physicians and surgeons, recommended by "The Homeopathic Medical Society of Arkansas"; one of physicians and surgeons, recommended by "The Arkansas State Eclectic Medical Society": and one of physicians and surgeons, recommended by "The Arkansas Medical Society."

There shall be seven members of each Board, appointed so as to have one member from each Congressional District upon each Board. The appointment shall be made by the Governor from a list of names presented by the respective medical societies.

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SEC. 4.—The said Boards shall hold four regular stated meetings per year, to wit: The second Tuesdays in January, April, July and October, at such places as a majority may agree upon, consulting the convenience of the Boards and applicants for examination and certificates.

Special meetings may be held upon the call of the President whenever it is deemed necessary or expedient. Said Boards shall keep a record of all their proceedings, together with a correct list of all applicants for license to practice medicine, in any of its branches, with name, sex, color, age, nativity; time spent in the study of medicine, and, if possessing a diploma, the name and locality of the institution granting same, stating the system of medicine followed by each.

This record shall also state whether the applicant was rejected or licensed; said record shall be prima facie evidence of all matters required to be kept therein, and a certificate issued under the seal of said Board, and signed by the President and Secretary thereof, and shall be prima facie evidence in any of the courts of this State of any matter appearing upon said records.

SEC. 5.—The Boards shall be styled and known as the "Homeopathic State Medical Board," the "Eclectic State Medical Board," and the "State Medical Board of the Arkansas Medical Society."

The "Homeopathic State Medical Board" shall examine all applicants who propose to practice the homeopathic system of medicine; the "Eclectic State Medical Board" shall examine all applicants who pro-

pose to practice the eclectic system of medicine; and the "Board of Arkansas Medical Society" shall examine all other applicants.

The Boards shall act separately and independently of each other, and whenever this act refers to and defines the duties of the Board, it shall be construed as referring to their acting separately, as well as independently of each other.

SEC. 6.—Every person now practicing medicine in this State shall, within ninety days after the passage of this act, prepare a written statement, giving his name, postoffice address and county; when and where he received authority to practice medicine in this State; where his diploma or certificate is on record; and, if a diploma, from what school or medical college issued; such statement shall be sworn to before some officer authorized to administer oaths, and shall be forwarded to the Secretary of the Board representing his school of medicine.

If it shall appear from such statement that such person was regularly authorized to practice medicine under the then existing laws, said Board shall register the name of such person in their list of accredited physicians and issue to such person a certificate that his name has been placed upon such list. If it shall appear from the statement that such person has not been legally authorized to practice medicine, or that his diploma is not from a reputable medical school or college, or, if from any other source of information, it shall appear that the statement is false, the Board shall refuse to issue to such a person a certificate, and shall notify such person in writing of their refusal and the reason therefor. If such person shall show to the satisfaction of the Board by affidavits or otherwise that he has complied with the laws of this State regulating the practice of medicine, they shall in that event issue to him a certificate. Upon the failure of such person to make the proof required by this section, he shall, before continuing in the practice, make application and stand examination by the following provisions of this act.

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SEC. 8.—Every person residing in this State, or coming into it, of the age of twenty-one years, who has not heretofore been licensed to practice medicine under the existing laws, making application to register under the provisions of this act for the purpose of practicing medicine and surgery in this State, shall first make application to the Secretary of the Board, and his application shall be accompanied by a fee of Ten ($10) Dollars, this fee being for examination and registration before this Board. Such examination may be written or oral at the discretion of the Board, and shall be elementary and of a practical character, including anatomy, physiology, chemistry, materia medica, theory and practice of medicine, surgery and obstetrics.

If, in the opinion of the Board, the applicant possesses the necessary qualifications, the Board shall issue to him a certificate.

SEC. 9.—Every person receiving a certificate from the Board, whether practicing now or hereafter licensed to practice, shall have

such certificate recorded in the office of the County Clerk where he is practicing or proposes to practice; and, when such person moves to another county for the purpose of continuing the practice of medicine, he shall file for record with the County Clerk of the County to which he moves, a certified copy of his certificate.

SEC. 10.—That to prevent delay and inconvenience any member of the Board applied to may grant an applicant a temporary permit to practice, upon the payment of the fee required of applicants, and after a satisfactory examination, such permit shall not continue in force longer than until the next regular meeting of the Board and shall in no case be granted within six months after the applicant has been refused a certificate by the Board.

No additional fee shall be charged the applicant by the Board who has previously paid the amount for a temporary permit. All amounts paid to members of the Boards for temporary permits, shall be by such members paid to their respective Treasurers.

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SEC. 16.—All laws or parts of laws in conflict with this act are hereby repealed, and this act shall take effect and be in force 90 days after its passage.

Approved Feb. 17, 1903.

CALIFORNIA

LAW REGULATING THE PRACTICE OF MEDICINE IN THE STATE OF CALIFORNIA. IN EFFECT MAY 1, 1907.

An act for the regulation of the practice of medicine and surgery, osteopathy, and other systems or modes of treating the sick or afflicted, in the State of California and for the appointment of a Board of medical examiners in the matter of said regulations.

The people of the State of California represented in Senate and assembly, do enact as follows:

SECTION 1.—The governor shall appoint a board of medical examiners to be known as the board of medical examiners of the State of California, consisting of eleven members. Such appointments shall be made from separate lists presented to him every second year; five members from a list of ten names presented by the Medical Society of the State of California, two members from a list of four names presented by the California State Homeopathic Medical Society, two members from a list of four names presented by the Eclectic Medical Society of the State of California and two members from a list of four names presented by the Osteopathic Association of the State of California.

. . . . . .

SECTION 6.—Three forms of certificate shall be issued by said board under the seal thereof and signed by the president and the secretary: first, a certificate authorizing the holder thereof to practice medicine and surgery; second, a certificate authorizing the holder thereof to practice osteopathy; third, a certificate authorizing the holder thereof to practice any other system or mode of treating the sick or afflicted not referred to in this section.

In order to procure a certificate to practice medicine and surgery, the applicant for such certificate must file with said board, at least two weeks prior to a regular meeting thereof, satisfactory testimonials of good moral character, and a diploma issued by some legally chartered medical school, the requirements of which shall have been at the time of granting such diploma in no particular less than those prescribed by the association of American Medical Colleges for that year, or satisfactory evidence of having possessed such diploma, and he must also file with said diploma an application sworn to before some person authorized to administer oaths, and attested by the hand and seal of such officer if he have a seal, stating that he is the person named in said diploma, that he is the lawful holder thereof, and that the same was procured in the regular course of instruction and examination, without fraud

or misrepresentation. The said application shall be made upon a blank furnished by said board, and it shall contain such information concerning the medical instruction and preliminary education of the applicant as said board may by rule provide. Applicants who have failed to meet the above requirements must be rejected. Applicants for a certificate to practice osteopathy shall be subject to the above regulations, except that in place of the diploma herein before referred to, they shall be required to file a diploma from a legally chartered college of osteopathy, having a course of instruction of at least twenty months, requiring actual attendance, and after 1908, of three years of nine months each, and including the studies examined upon under this act. Applicants for a certificate to practice any other system or mode of treatment not in this act referred to, shall be subject to the above regulations, except that in place of the diplomas hereinbefore referred to, they shall be required to file a diploma from a legally chartered College of the system or mode of treatment which the applicant claims or intends to follow. In addition to the requirements above set forth, all applicants for a certificate must be personally examined by said board as to their qualifications. The examination shall be conducted in the English language, shall be practical in character and designed to discover the applicant's fitness to practice his profession, and shall be, in whole or in part, in writing on the following fundamental subjects to wit: Anatomy histology, gynecology, pathology, bacteriology, chemistry and toxicology, physiology, obstetrics, general diagnosis, hygiene. Examination in each subject shall consist of not less than ten questions, answers to which shall be marked upon a scale of zero to ten. But all applicants must obtain not less than a general average of seventy five percent and not less than sixty percent in any one subject: provided, that applicants who can show at least ten years of reputable practice shall be granted a credit of five percent upon the general average, and five percent additional for each subsequent ten years of such practice. . . . .

Section 7.—Each applicant on making application shall pay to the secretary of the board a fee of twenty-five ($25) dollars, which shall be paid to the treasurer of the board by said secretary. In case the applicant's credentials are insufficient, or in case he does not desire to take the examination the sum of ten (10) dollars will be retained, the remainder of the fee being returnable on application.

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Section 9.—Every person holding a certificate authorizing him to practice medicine and surgery, or osteopathy, or any other system or mode of treating the sick or afflicted, in this state, must have it recorded in the office of the county clerk of the county in which the holder of said certificate is practicing his profession and the fact of such recording shall be indorsed on the certificate by the county clerk recording the same. Every such person, on each change of his residence must have his certificate recorded in the county to which he shall have changed his

residence. The absence of such record shall be prima facie evidence of the want of possession of such certificate. And any person holding a certificate who shall practice medicine or surgery or osteopathy or any other system or mode of treating the sick or afflicted in this state, or to attempt to practice medicine or surgery or osteopathy or any other system or mode of treating the sick or afflicted, in this state, without first having filed his certificate with the county clerk as herein provided, shall be guilty of a misdemeanor, and shall be punished by a fine of not less than twenty-five dollars nor more than one hundred dollars or by imprisonment for a period of not less than thirty days, nor more than sixty days, or by both such fine and imprisonment.

. . . . . .

SECTION 11.—Said board must refuse a certificate to any applicant guilty of unprofessional conduct: but before such refusal the applicant must be cited by citation, signed by the secretary of the board, and sealed with its seal. No such citation shall be issued except upon a sworn complaint filed with the secretary of the board, charging the applicant with having been guilty of unprofessional conduct and setting forth the particular acts consituting such unprofessional conduct.

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REVOCATION OF CERTIFICATE

The words, "unprofessional conduct," as used in this act are hereby declared to mean,

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First.—The procuring or aiding or abetting in procuring a criminal abortion.

Second.—The wilfully betraying a professional secret.

Third.—All advertising of medical business which is intended or has a tendency to deceive the public or impose upon credulous or ignorant persons, and so be harmful or injurious to public morals or safety.

Fourth.—All advertising of any medicines, or of any means, whereby the monthly periods of women can be regulated, or the menses reestablished if suppressed.

Fifth.—Conviction of any offense involving moral turpitude, in which case the record of such conviction shall be conclusive evidence.

Sixth.—Habitual intemperance.

Seventh.—The personation of another licensed practitioner of a like or different name.

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SECTION 16.—Any person who holds a certificate from the board of medical examiners created by, "an act for the regulation of the practice of medicine and surgery in the State of California, and for the appointment of a board of medical examiners in the matter of such regulation" which took effect August the first, nineteen hundred and one, or from

one of the boards of examiners heretofore existing under the provisions of "an act to regulate the practice of medicine in the State of California" approved April third, eighteen hundred and seventy-six, or an act supplemental and amendatory to said act, which became a law, April first, eighteen hundred and seventy eight, shall be entitled to practice medicine and surgery in this state, the same as if it had been issued under this act; any person who holds a certificate from the board of osteopathic examiners of the State of California, under the provision of "an act to regulate the practice of Osteopathy in the State of California and to provide for a state board of osteopathic examiners, and to license to practice in this State, and to punish persons violating the provisions of this act" which became a law under constitutional provisions, without the governor's approval, March ninth, nineteen hundred and one, shall be entitled to practice osteopathy in this state, the same as if it had been issued under this act: but all certificates herein mentioned may be revoked for unprofessional conduct and in the same manner, and upon the same grounds, as if they had been issued under this act.

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COLORADO

EXTRACTS FROM THE COLORADO LAW REGULATING THE PRACTICE OF MEDICINE. Approved April 20, 1905.

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SECTION 4.—Any person wishing to obtain the right to practice medicine in this State, who has not heretofore been licensed so to do, shall, ... make application to said State Board of Medical Examiners, through the secretary-treasurer thereof, ... and obtain from the board a license so to do. . . . .

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SECTION 6.—There shall be paid to the secretary-treasurer of the State Board of Medical Examiners by each applicant for a license a fee of twenty-five dollars ($25.00), which shall accompany the application. Two-fifths of the fee shall be returned to the applicant in case the board shall refuse to grant him a license.

SECTION 7.—Examinations of applicants for license to practice medicine shall be made by said State Board of Medical Examiners according to the methods deemed by it to be the most practicable and expeditious to test the applicant's qualifications. Such applicant will be designated by a number instead of his name, so that his identity will not be disclosed to the members of the board, until after the examination papers are graded. The subjects of written, oral or clinical examinations shall be as follows: Anatomy, physiology, chemistry, symptomatology, toxicology, pathology, surgery and obstetrics (exclusive of materia medica and therapeutics). The credentials of applicants relating to their general reputation, their preliminary education and the courses of study they have pursued; the degrees they have received; the number of years they have been engaged in the lawful practice of medicine; their experience in general hospitals, medical departments of the army, navy and public health and marine hospital service; licenses granted to them by other states and countries; and their experience as teachers of medicine, shall be given due consideration by the board in conducting its examinations. Upon investigation of an applicant's credentials the board shall, when convinced that an applicant is qualified to practice medicine, grant him a license thereon without further examination. Each applicant shall name his system of practice and no person shall use the name of any system unless he holds a certificate from the State association of such system.

SECTION 8.—Every person who shall receive a license from the State Board of Medical Examiners shall have it recorded in the office

of the recorder of deeds of the county in which he resides, and shall likewise have it recorded in the counties to which he shall subsequently remove for the purpose of practicing medicine. The failure on the part of the holder of a license to have it recorded, before he shall begin the practice of medicine in this State, shall render it null and void.

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SECTION 11.—Nothing in this act shall be construed to prohibit gratuitous service in case of emergency, nor the practice of the religious tenets or general beliefs of any church whatsoever, not prescribing medicine or administering drugs, nor shall it apply to commissioned surgeons of the United States army, navy, or public health and marine hospital service, while so engaged, nor to regularly licensed physicians called from other states or territories to attend specific cases in this State, nor the practice of dentistry, nor the practice of osteopathy when not prescribing medicine, or administering drugs.

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CONNECTICUT

EXTRACTS FROM THE GENERAL STATUTES OF CONNECTICUT. REVISION OF 1902. TITLE FIFTY-ONE. CHAPTER 274.

§4714.—*Who may practice medicine, surgery, or midwifery.* No person shall, for compensation, gain or reward, received or expected, treat, operate, or prescribe for any injury, deformity, ailment or disease, actual or imaginary, of another person, nor practice surgery or midwifery, until he has obtained such a certificate of registration as is in §4715 provided, and then only in the kind or branch of practice stated in said certificate; but this chapter shall not apply to dentists while practicing dentistry only; nor to any person in the employ of the United States government while acting in the scope of his employment; nor to any person who shall furnish medical or surgical assistance in cases of sudden emergency; nor to any person residing out of this state who shall be employed to come into the state to assist or consult with any physician or surgeon who has been registered in conformity with the provisions of this chapter; nor to any physician or surgeon then actually residing out of this state who shall be employed to come into this state to treat, operate or prescribe for any injury, deformity, ailment or disease from which any person is suffering at the time when such non-resident physician or surgeon is so employed nor to any actual resident of this state recommending by advertisement or otherwise the use of proprietary remedies sold under trade-marks issued by the United States government, in so far and to such extent only as the use of such remedies are concerned; nor to any chiropodist or clairvoyant who does not use in his practice any drugs, medicines or poison; nor to any person practicing the massage method, or Swedish movement cure, sun cure, mind cure, magnetic healing, or Christian science; nor to any other person who does not use or prescribe in his treatment of mankind drugs, poisons, medicines, chemicals or nostrums.

§4715.—*Requirements for obtaining certificate of registration.* (This section has been amended by an Act concerning the practice of medicine and surgery and midwifery, passed by the General Assembly January, 1903.) No person shall obtain a certificate of registration as in section 4714 required until he has passed a satisfactory examination before one of the examining committees appointed for the purpose by the state board of health, except as hereinafter provided, nor until he has filed with said board duplicate certificates signed by a majority of said examining committee, stating that they have found him qualified to practice either medicine, surgery, or midwifery, nor until he has filed with said board duplicate statements subscribed and sworn to by him upon blanks

furnished by said board, giving his name, age, place of birth, and present residence, stating of what medical college he is a graduate, and the date of such graduation, together with such other information as shall be required by said blanks. No person shall be eligible to said examination until he presents to the committee, by whom he is to be examined, satisfactory evidence that he has received a diploma from some legally incorporated medical college. Any one of the examining committees appointed under the provisions of section 4716 may accept the license of any state board of medical examiners of any state in the United States or in the District of Columbia in lieu of said examination, provided the applicant shall present such license to the examining committee before whom he appears, together with satisfactory evidence that such license has been issued after a state examination of as high a grade and of the same kind as that required by said examining committee, that he is a resident of this state, or that he intends in good faith to permanently reside herein, that he has been in actual practice for a period of at least six months in the year immediately preceding the date of his application, and that he is of good moral character and professional standing; and upon the payment to said committee of the sum of fifteen dollars he may receive a certificate of the approval of such license by said examining committee. Any person passing such examination or obtaining such certificate of approval and filing said certificates and statements shall receive from said state board of health, upon payment of two dollars, a certificate of registration, which shall state that the person named has been found qualified so to practice.

§4716.—*Nomination and appointment of members of examining committees.* The Connecticut medical society, the Connecticut homeopathic medical society, and the Connecticut eclectic medical society shall each annually in December file with the state board of health the name of one physician, practicing in this state, who shall have been recommended by such medical society as a person competent to serve upon one of the examining committees appointed by the state board of health, as specified in chapter 158 of the public acts of 1893; and in case any vacancy occurs upon any of said examining committees, the president of the society of whose members said committee is composed shall nominate such a person to fill said vacancy. Annually in January the state board of health shall appoint one member of each of said committees, who shall have been nominated for such office as aforesaid, to serve five years; and said board shall in the same manner fill any vacancy occurring in any of said committees.

§4717.—*Examination through interpreter.* Every examining committee provided for in §4716 shall, when requested by an applicant for a certificate permitting said applicant to practice midwifery, if said applicant does not understand the English language, conduct the examination through an interpreter of the language which the applicant understands. Said interpreter shall be furnished and paid by the applicant, and shall give the committee conducting the examination satisfac-

tory proof of his ability correctly to translate the language of the applicant into English. Whenever such applicant shall have satisfactorily passed an examination so conducted, a certificate of registration shall be issued as provided in §4715.

§4718.—*Examinations. Papers recorded. Lists of colleges.* The said examining committees shall hold examinations on the second Tuesdays of March, July, and November of each year, at such places as they may designate, and at such times and places as they shall determine. Applicants for certificates to practice medicine or surgery shall be examined in anatomy, physiology, medical chemistry, obstetrics, hygiene, surgery, pathology, diagnosis, and therapeutics, including practice and materia medica. Each committee shall frame its own questions and conduct its examinations in writing, and both questions and answers shall be filed with the state board of health. Each applicant shall choose by which one of the three committees he shall be examined; but before taking such examination he shall pay to the committee the sum of fifteen dollars, *provided*, that the fee for midwifery alone shall be ten dollars. An applicant, rejected by an examining committee, shall not be eligible to re-examination, until after the expiration of twelve months.[1]

Upon the receipt of any duplicate statements as in §4715 provided, the state board of health shall transmit one of said duplicate statements, together with a duplicate of the certificate of registration in each case, to the town clerk of the town wherein the person so filing said statement resides; and in case such person does not reside in the state of Connecticut, the state board of health shall transmit said statement and certificate to the town clerk of the town in this state nearest to the place of residence of such person, and said town clerk shall record the same in a book to be provided for that purpose by the state board of health, and shall then return the same to the person who filed the same with the board of health; and said town clerk shall receive for such recording a fee of twenty-five cents, to be paid by the state board of health out of the amount so paid to it as aforesaid. The secretary of each of said medical societies shall file with the secretary of the state board of health, a list of medical colleges or institutions recognized as legal and reputable by his society; or all of such secretaries may agree upon a single list; and such list or lists may be corrected as may be necessary.

§4719.—*Exceptions. Prescription in English. Penalties. Clerk.* Nothing in this chapter shall be construed to repeal or affect any of the provisions of any private charter. The provisions of this chapter shall not apply to licensed pharmacists. All physicians or surgeons practicing under the provisions of this chapter shall, when requested,

[1]This last sentence has been amended by the same Act as mentioned under Section 4715, and should read "An applicant rejected by an examining committee shall not be eligible to examination before either of the other examining committees until after the expiration of twelve months, but may be re-examined by the committee before whom he appeared, at any subsequent meeting of said committee."

write a duplicate of their prescriptions in the English language. Every person who violates the requirements of this section regarding prescriptions shall be fined ten dollars for each offense. Every person violating any provision of §4714 shall be fined not less than one hundred dollars nor more than three hundred dollars for the first offense, and for each subsequent offense not less than two hundred nor more than five hundred dollars, or imprisoned in the county jail for not less than thirty nor more than ninety days, or both; the fine, when collected, shall be paid one-half to the person or corporation making the complaint, and the other half to the state board of health. Every person who shall swear to any falsehood in any statement required by §4715 to be filed with the state board of health shall be guilty of perjury. The state board of health may appoint a clerk, and fix his salary, to be paid only out of the fees and penalties received under the provisions of this chapter.

§4720.—*Revocation of certificate.* The secretary of the state board of health, upon the written request of all the members of any one of the examining committees mentioned in §4716, may revoke and cancel the certificate of registration of any person convicted of any crime in the practice of his professional business, or convicted of a felony; but no one of the examining committees shall have the right to request the revocation and cancellation of a certificate granted upon the examination of any one of the other examining committees.

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§4729.—*Cases not covered by preceding sections.* Nothing contained in the preceding sections of this chapter shall prevent a practicing physician from compounding his own prescriptions, or prevent the sale of proprietary medicines, or prevent the sale of any drugs, medicines, or poisons at wholesale either to licensed pharmacists, or for use in manufactures or the arts, or prevent any person from becoming a partner in, or the proprietor of, a pharmacy conducted by a licensed pharmacist, or prevent any keeper of a country store from keeping for sale and selling such domestic remedies as are usually kept and sold in such stores; but such keeper shall not compound medicines, and medicinal preparations so kept, and recognized by the United States dispensatory, shall be compounded by a licensed pharmacist and marked by his label.

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§4749.—Physician or surgeon may practice dentistry. The provisions of this chapter shall not prevent a practicing physician or surgeon from the performance of an operation in dentistry on a patient under his charge, nor a lawfully practicing dentist from availing himself of the services of any pupil, student, or assistant, employed by him and under his immediate supervision.

DELAWARE

AN ACT REGULATING THE PRACTICE OF MEDICINE AND SURGERY IN THE STATE OF DELAWARE.

WHEREAS, The safety of the public may be endangered by incompetent physicians and surgeons, and due regard for the public health and the preservation of human life depends that none but competent and properly qualified physicians and surgeons shall be allowed to practice their profession, therefore,

Be it enacted by the Senate and House of Representatives of the State of Delaware in General Assembly met:

SECTION 1.—That there shall be established a Medical Council of Delaware, consisting of the Chief Justice of the State and of the Presidents of the two State Boards of Medical Examiners provided for in this act.

SECTION 2.—The said Council shall be known by the name and style of the "Medical Council of Delaware," and may make and adopt all necessary rules, regulations and by-laws for their own government, not inconsistent with the laws of this State or of the United States, and shall have power to locate and maintain an office within this State for the transaction of business. Two members of said Council shall constitute a quorum for the transaction of business.

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SECTION 5.—The said Medical Council shall hold two stated meetings in each year, and may hold special meetings at such times as it may deem proper. It shall issue certificates for license to practice medicine and surgery to such applicants as have presented such diplomas as hereinafter required and successfully passed the examination hereinafter provided, and the said Medical Council shall have no powers, duties or functions except as provided for in this act.

SECTION 6.—That from and after the passage of this act there shall be, and continue to be, two separate boards of Medical Examiners for the State of Delaware, one representing "The President and Fellows of the Medical Society of Delaware," and the other "The Homeopathic Medical Society of Delaware State and Peninsula.

Each board shall consist of five members, and each of said number shall serve for a term of two years from the first day of March next after appointment, with the exception of those first appointed, who shall serve as follows, namely: two of each board for one year, and three of each board for two years, from the first day of March, A. D. 1895. . . . .

SECTION 7.—Said boards shall be known by the name and style of "Boards of Medical Examiners of the State of Delaware." . . . . .

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SECTION 10.—Each Board of Medical Examiners, not less than one week prior to each examination, shall submit to the Medical Council of Delaware questions for thorough examinations in anatomy, physiology, hygiene, chemistry, surgery, obstetrics, pathology, diagnosis, therapeutics, practice of medicine and materia medica.

The medical Council shall select the question for such examinations from the lists of questions submitted by the Board of Medical Examiners of the candidate's election; and should there be candidates for examination for any other school than the two designated in this act, they shall be examined by the Council and some reputable practioner in this State of such school, by said Council to be selected, upon questions selected from standard text-books on the above subjects as taught by the schools selected by the candidate.

SECTION 11.—Said examination shall be conducted in writing in accordance with the rules and regulations prescribed by the respective Boards of Medical Examiners, and shall embrace the subjects named in Section 10 of this act. After each examination the Board of Medical Examiners having charge thereof shall, without unnecessary delay, act on the same. An official report of such action, signed by the president, secretary and each acting member of said Board of Medical Examiners, stating the result of examination, shall be transmitted to the Medical Council.

SECTION 12.—On receiving from either of said Boards of Medical Examiners such official report of the examination of any applicant for certificate for license, the Medical Council shall issue forthwith to each applicant who shall have been returned as having successfully passed the examination a certificate to that effect.

The Medical Council shall keep a record of all certificates, when and to whom issued.

SECTION 13.—(Replaced by Section 1, Chapter 139, Vol. 24. Approved March 25, 1907.)

SECTION 1.—That Section 13, Chapter 40, Vol. 20, Laws of Delaware, be and the same hereby is stricken out and the following substituted therefor: "From and after the passage of this Act, any person not heretofore authorized to practice medicine and surgery in the State, and desiring to enter upon such practice, shall deliver to the Secretary of the Medical Council upon the payment of a fee of Ten Dollars ($10) a written application for examination together with satisfactory proof that the applicant is more than twenty-one years of age, is of good moral character, has obtained a diploma from some reputable literary or scientific college, or a certificate from the faculty of Delaware College signed by the President and attested by the Secretary thereof, that he or she is qualified to enter the freshman class of the Latin Scientific Course of said College; and has received a diploma conferring the degree of Doctor of Medicine, from some legally incorporated medical college, which, in the opinion of the Medical Council, was in good standing at the time of the issuing of the said diploma. Applicants who have

received their degree in medicine after the passage of this act, must have pursued the study of medicine for at least four years, including four regular courses of lectures of not less than seven months each, in different years, prior to the granting of said degree, in some legally incorporated medical college or colleges, approved by the Medical Council. Such proof, shall be made upon affidavit. Upon the making of said payment and proof, the Medical Council shall issue to said applicant an order for examination before such one of the State Boards of Medical Examiners as the affidavit for certificate may select. In case of failure at any such examination, the candidate, after the expiration of six months and within two years, shall have the privilege of a second examination by the same Board to which application was first made, without the payment of an additional fee, but if after six months and before two years from such examination, said application shall be withdrawn, the said Ten Dollars ($10) shall upon demand be returned. Provided that applicants for license who graduated prior to July 1st, A. D. 1901, and have been in continuous and reputable practice for at least five years since graduation, may be admitted to the examinations of one of said Boards; upon certified and satisfactory evidence of good moral character, of three courses of medical lectures, in different calendar years, and of a competent academic education according to the requirements of that time; and provided further, that applicants for license who graduated prior to July 1st, A. D. 1896, and have been in continuous and reputable practice for at least ten years, may be admitted to the examination of one of said Boards upon certified and satisfactory evidence of moral character, of two courses of medical lectures, in different calendar years, and of a competent academic education, according to the requirements of that time."

Section 14.—That from and after the passage of this Act, it shall not be lawful for any person to practice Medicine or Surgery in this State without having obtained a license therefor as hereinafter provided.

Supplemented by Section 2, Chapter 139, Vol. 24. Approved March 25, 1907.

Section 2.—That Section 14, Chapter 40, Volume 20, Laws of Delaware, be and the same hereby is amended by adding thereto after the word provided, the following, to wit. "But a temporary license, of not less than two weeks, nor more than four months, may be granted to a resident and legally qualified physician of another State to take charge of the practice of a resident and legally qualified physician of this State, during the latter's temporary illness or absence from this State, and the payment to the Secretary of the Medical Council of a fee of two dollars ($2) for the use of said council, and when such temporary license is so issued, the physician receiving such license shall have the right to practice medicine in the State of Delaware for the time specified in said temporary license."

. . . . . .

SECTION 15.—The Clerk of the Peace of any of the Counties of this State shall issue a license signed by the Governor and countersigned by the Secretary of State and sealed with the seal of his office, certifying that such person is authorized to practice Medicine and Surgery in this State, conformably to the laws thereof, to any person who shall present to him a certificate as provided in this Act, or who shall have been qualified in one of the counties of this State prior to the passage of this Act, and to no other person.

SECTION 16.—The provisions of this Act shall not apply to Physicians who are practitioners of any other State, coming into this State in consultation with any lawful Practitioner of Medicine and Surgery in this State.

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Passed at Dover, April 18, 1895.

Supplemented by Sections 3 and 4, Chapter 139, Vol. 24. Approved March 25, 1907.

SECTION 3.—That Chapter 40, Volume 20, Laws of Delaware, be and the same hereby is amended by adding thereto, which shall be designated as Section 20 of said chapter 40, Volume 20, Laws of Delaware, the following, to wit: "For the purposes of this act and the act to which this is an amendment, the words, practice of medicine, or surgery, shall mean to open an office for such purpose, or to announce to the public, or to any individual, in any way, a desire or willingness or readiness to treat the sick or afflicted in any county in the State of Delaware, or to investigate or diagnosticate, or to offer to investigate or diagnosticate any physical or mental ailment, or disease, of any person, or to give surgical assistance, to, or to suggest, recommend, prescribe, or direct for the use of any person, any drug, medicine, appliance or other agency, whether material or not material, for the cure, relief or palliation of any ailment or disease of the mind or body, or for the cure or relief of any wound, fracture or bodily injury, or deformity, after having received or with the intent of receiving therefor, either directly or indirectly, any money, gift, or any other form of compensation. It shall also be regarded as practicing medicine within the meaning of this act if any one shall use in connection with his or her name, the words or letters Dr., Doctor, Professor, M. D., M. B., or healer, or any other title word, letter, or other designation which may imply or designate him or her as a practitioner of medicine, or surgery, in any of its branches; provided that nothing in this act nor the act to which this is an amendment, shall be construed to apply to the administration of domestic or family remedies in cases of emergency, or to dentists or dental surgeons in the practice of dentistry or to surgeons of the United States Army or Navy in the discharge of their official duties or to prevent the mechanical application of glasses provided, that nothing contained in this act shall prevent. . . . .

SECTION 4.—That Chapter 40, Volume 20, Laws of Delaware, be and the same hereby is amended by adding thereto, which shall be designated as Section 21, of said Chapter 40, Volume 20, Laws of Delaware, the following, to wit: "Any practitioner of the system, method or science of treating diseases of the human body, commonly known a Osteopath, who is a graduate of any legally chartered and regularly conducted school of Osteopathy, which in the opinion of the Medical Council shall be in good standing, who holds a diploma regularly issued from such school, and who has been in personal attendance as a student in such school for at least four terms of not less than five months each before graduation, and who is now located and practicing in this State, is hereby authorized to so practice, without conforming to, and notwithstanding, any provisions of this act, or of the act to which this act is an amendment, upon such practitioners of Osteopathy paying to the State the State License tax prescribed by law for physicians."

"That all other persons proposing to practice Osteopathy in this State after the passage of this act shall be subject to the provisions of this act and of the act to which this act is an amendment provided that such future applicants to practice Osteopathy in this State shall be examined by the Medical Council and some reputable practitioner of Osteopathy in this State, or, if there then shall be no reputable practitioner of Osteopathy then residing in this State, by Medical Council and some practitioner of Osteopathy from some other State, to be designated by the Medical Council, and provided further than such future applicants to so practice shall be examined only upon such questions as shall be selected by the Medical Council and such selected associated practitioners of Osteopathy in Anatomy, physiology, hygiene, chemistry, obstetrics, pathology, physical diagnosis, histology, gynecology, surgery, urinalysis, and principles of Osteopathy. Any person who is the holder of a diploma regularly issued by any legally chartered and regularly conducted school of Osteopathy, who has been in personal attendance as a student in such school for at least three years for terms of not less than seven months in each year before graduation and who shall conform to the provisions relative to general education, shall be eligible to such examination by said Medical Council, notwithstanding any of the provisions of this act." . . . .

Approved March 25, 1907.

A Supplement to an Act entitled "An Act Regulating the Practice of Medicine and Surgery in this State," passed at Dover, April 18, 1895.

Be it enacted by the Senate and House of Representatives of the State of Delaware, in General Assembly met:

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SECTION 2.—That applicants examined and licensed by or who are or have been members of the State Examining and Licensing Boards

of other States upon the payment of fifty dollars to the Treasurer of the Medical Council of Delaware, and on filing with the Secretary of said Medical Council a copy of his or her license of certificate certified to by the affidavit of the President and Secretary of such Board, showing also that the standards of requirement of the said Board at the time the said license or certificate was issued, was substantially the same as that required by the said Medical Council of Delaware, and of his or her affidavit as to the personality thereof, may be granted a certificate for a license to practice medicine and surgery by the said Medical Council, upon the recommendation of the said Boards of Medical Examiners without further examinations thereby.

. . . . . .

DISTRICT OF COLUMBIA

An Act to regulate the practice of medicine and surgery, to license physicians and surgeons, and to punish persons violating the provisions thereof in the District of Columbia.

(29 STATS., 198.)

Be it enacted by the Senate and House of Representative of the United States of America in Congress assembled, That there shall be, and is hereby, created a board of medical supervisors of the District of Columbia, which shall consist of the presidents of the 3 boards and 2 others not physicians, one of whom must be trained in law.

. . . . . .

SEC. 2.—That the said board of medical supervisors shall elect a president, a vice-president, and a secretary. Said board shall make, subject to the approval of the Commissioners of the District of Columbia, such regulations as may be necessary to carry into effect the provisions of this act. . . . .

SEC. 3.—That from and after the passage of this act all persons desiring to practice medicine and surgery in any of their branches in the District of Columbia shall apply to said board of medical supervisors for a license to do so. Applicants shall submit to examination upon the following-named branches, to wit:

Anatomy, physiology, chemistry, pathology, materia medica and therapeutics, hygiene, histology, practice of medicine, surgery, obstetrics and gynecology, diseases of the eye and the ear, medical jurisprudence, and such other branches as said board shall deem advisable. Each applicant shall be certified by said board for examination as speedily as possible to the board of medical examiners whose members are adherents to the system of medicine which said applicant desires to practice; but said board shall not certify for examination any applicant until satisfactory proof is furnished that he or she is of good moral character and over twenty-one years of age, nor until he or she has presented a diploma conferring upon him or her the degree of doctor of medicine, issued by some medical college authorized by law to confer such degree: *Provided,* That said diploma, if issued prior to July first, eighteen hundred and ninety-eight, shall be accompanied by satisfactory evidence that said applicant has studied medicine and surgery for not less than three years prior to the issue thereof, and if issued subsequent to June thirtieth, eighteen hundred and ninety-eight, shall be accompanied by satisfactory evidence that the applicant

has studied medicine and surgery for not less than four years prior to the issue of said diploma. All examinations shall be both theoretical and practical, and of sufficient severity to test a candidate's fitness to practice medicine and surgery.

SEC. 4.—That said application for a license to practice medicine and surgery in the District of Columbia shall be made to the secretary of said board of medical supervisors upon a form prescribed by said board, and shall be accompanied by a fee of ten dollars. Each application shall be in the hands of each secretary not less than two weeks before the day set for examination, and any application may be rejected for refusal to furnish any of the information called for, or for other irregularity. All applications shall be kept on file by said secretary.

. . . . . .

SEC. 6.—. . . . Each board shall hold a meeting for examination in the city of Washington on the second Thursday in January, April, July and October of each year, and continuing so long as may be necessary to examine all applicants, and other meetings shall be held at such times as the board of medical supervisors shall direct. Each of said boards shall examine, at the meeting immediately following the receipt of the proper certificates from the board of medical supervisors, all applicants for licenses to practice medicine and surgery in the District of Columbia so certified.

SEC. 7.—That the several boards of medical examiners shall, not less than one week prior to each examination, submit to the board of medical supervisors of the District of Columbia questions for thorough examinations in anatomy, physiology, chemistry, pathology, materia medical and therapeutics, hygiene and histology, practice of medicine, surgery, obstetrics and gynecology, diseases of the eye and ear, medical jurisprudence and such other branches as said board of medical supervisors may direct. From the list of questions so submitted said board of medical supervisors shall select the questions for each examination, and such questions shall be the same for all candidates, except that in the departments of therapeutics, practice of medicine and materia medica the questions shall be in harmony with the system of medicine selected by the candidate. Said examinations shall be conducted orally and in writing, in accordance with the rules and regulations prescribed by the board of medical supervisors, and shall embrace the subjects so stated in section three of this act. . . . .

SEC. 8.—That if in the opinion of a majority of the board of medical supervisors, after a careful examination of the report of the board of medical examiners by which any applicant was examined, said applicant has fairly and successfully passed such examination as hereinbefore provided for, the board of medical supervisors of the District of Columbia shall, as soon thereafter as possible, issue to him a license signed by the president and the secretary of said board and attested by the seal of the District of Columbia, which license shall entitle said applicant, after

it is registered as hereinafter provided to practice medicine and surgery in the District of Columbia: *Provided*, That a license shall be issued upon application, free of cost and without examination, to each physician who is registered at the health office of the District of Columbia at the time of the passage of this act, and to physicians who may change their residence to the District of Columbia from any State or Territory where medical laws and medical examining boards exist, the presentation of a certificate or license from a medical examining board, if found upon due inquiry to be true and genuine, being sufficient evidence of right to registration and certification under the provisions of this act: *Provided*, That the medical laws and examining boards of such States and Territories grant equal rights and recognition to the licentiates of the board herein created. All licenses issued by said board shall be numbered consecutively, and a register shall be kept by the secretary showing the number of each license, the date of issue, and to whom issued.

Sec. 9.—That the board of medical supervisors of the District of Columbia shall make, subject to the approval of the Commissioners of said District, such regulations as may be necessary to determine the qualifications of women desiring hereafter to commence the practice of midwifery in the District of Columbia, and shall issue licenses to such as are, after examination, found qualified; but no fee shall be charged for the examination of any applicant for such licenses, and no applicant who has been rejected shall be re-examined within one year from such rejection: *Provided*, That a license shall be issued upon application, free of cost and without examination, to each midwife registered at the health office of the District of Columbia at the time of the passage of this act.

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Sec. 11.—That any person receiving a license as hereinbefore provided shall have it recorded in the office of the clerk of the supreme court of the District of Columbia within three months from the date of said license, and the place and date of record shall be certified thereon by said clerk; that the holder of the license shall pay to the said clerk of said court a fee of fifty cents for making the record. The holder of said license shall after the same has been recorded, exhibit the same at the health office, and shall register, in a book provided for that purpose, his or her name and address. Whenever a license is revoked by said board of medical supervisors the secretary thereof shall report that fact in writing to the clerk of said court and to the health officer of the District of Columbia, who shall thereupon cancel such registration.

Sec. 12.—That this act shall not apply to commissioned surgeons of the United States Army, Navy, or Marine-Hospital Service, nor to regularly licensed physicians and surgeons in actual consultation from other States or Territories, nor to regularly licensed physicians and surgeons actually called from other States or Territories to attend

specified cases in the District of Columbia, nor to the treatment of any case of actual emergency, nor to the practice of massage, or the so-called Swedish movement cure, nor to the use of ordinary domestic remedies without fee, gift, or consideration of any kind.

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Approved June 8, 1896.

FLORIDA

EXTRACTS FROM THE GENERAL STATUTES OF THE STATE OF FLORIDA, 1906, FIRST DIV., TITLE 11, CHAPTER 7.

MEDICAL EXAMINATIONS AND PHYSICIANS.

1156. *Requirements to Obtain Certificates.*— . . . . When any person has practiced medicine successfully and continuously for a period of fifteen years in the State of Florida, and is of good moral character, upon proof of these facts being made to the board of medicial examiners of the judicial circuit of the State where applicant resides, the said board of medical examiners, upon the application of such physician, shall examine said applicant in any recognized school of practice that said applicant may elect to be examined in, and if such physician is found to be competent, the said board of medical examiners shall issue to such applicant a certificate as it now provided by law.

CHAPTER 8.

Board of Eclectic Examiners.

1157. *Governor to Appoint.*—The Governor shall appoint a board of eclectic medical examiners for the State at large; said board shall be composed of three practicing eclectic physicians of known ability, who shall be graduates of a college of the eclectic school of medicine.

1158. *Examination of Applicants.*—The said board of eclectic medical examiners shall be authorized to examine all applicants who shall present a certificate of graduation (showing that such applicant has taken no less than a two years' course), from some college of the eclectic school of medicine, and shall not have authority to examine any applicant from any other school of medicine..

1159. *Duty of Board.* . . . .

CHAPTER 9.

Of Physicians.

1160. *Appointment of Medical Examiners.*—The Governor shall appoint a State board of medical examiners and also a State board of homeopathic medical examiners.

1161. *Qualifications of Examiners.*—The State board of medical examiners shall be composed of seven regular practicing physicians who have been duly licensed to practice in this State; no two members shall be residents of the same judicial circuit. The board of homeopathic examiners shall be composed of three practicing homeopathic

physicians who are graduated in good standing of some medical college recognized by the American Institute of Homeopathy.

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1164. *Regular Meetings.*—Each board shall meet regularly semi-annually at some central and convenient point in the State to conduct examinations, and grant licenses as herein provided, and they shall give at least one month's public notice of their meeting by publication once a week in a newspaper of general circulation throughout the State.

1165. *Examinations.*—It shall be the duty of said board of examiners to examine thoroughly every applicant for certificate of qualification to practice medicine in any of its branches or departments, upon the production of his medical diploma from a recognized college, or in the event said applicant shall have lost his diploma, or the same shall have been destroyed prior to the year 1870, then upon satisfactory evidence to such boards of such loss or destruction, upon the following subjects. Anatomy, physiology, gynecology, surgery, therapeutics, obstetrics, and chemistry, but no preference shall be given to any school of medicine: Provided, that it shall be the duty of the board of homeopathic medical examiners to examine thoroughly every applicant for certificate of qualification to practice medicine in any of its branches or departments, upon the production of his diploma from a college recognized by the American Institute of Homeopathy, upon the following subjects; Anatomy, physiology, surgery, gynecology, materia medica, therapeutics, obstetrics, and chemistry, and no preference shall be given to any school of medicine.

1166. *Certificates.*—When the board shall be satisfied as to the qualifications of an applicant they shall grant to him a certificate to that effect, which certificate shall entitle the person to whom granted to practice medicine in any county when the same shall have been recorded as required by Section 1169.

1167. *Temporary Certificate to Practice Medicine.*—Any member of the several boards of medical examiners in this State shall be authorized to grant a temporary certificate of qualifications to any applicant desiring to practice medicine in this State, upon examination, until the next regular meeting of the board; Provided, however, That the applicant has never before received a similar certificate from any member of the several boards. All temporary certificates shall cease to be of force at the regular meeting next after the granting of the same.

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1169. *Record of Certificate.*—The certificate provided for in the two preceding sections shall, before the person to whom it is granted shall be entitled to practice by virtue thereof, be recorded in the office of the clerk of the circuit court of the county in which such practitioner may reside or sojourn, in a well bound book to be kept by the clerk for that purpose, and when so recorded the clerk shall certify thereon under his

official seal the fact and date of such record, and shall return such certificate to the person to whom the same was granted, and shall be entitled for such service to collect from the holder of such certificate the legal fee for recording.

1170. *Examination Fee.*—The board shall be entitled to demand and receive from each applicant examined the sum of fifteen dollars, whether a certificate be granted to such applicant or not.

1171. *Provisions not to Apply to Certain Persons.*—The provisions of this chapter shall not apply to persons who have heretofore received certificates of qualification and have recorded the same as provided by the laws of this State heretofore existing not to females, who follow the practice of midwifery strictly as such. No persons, except those described in this section, shall be permitted to practice medicine in any of its branches or departments, without first having obtained and recorded a certificate of qualification from some authorized board of medical examiners as hereinbefore provided.

GEORGIA

CODE ADOPTED DECEMBER, 1895. 13TH TITLE, CHAPTER 4, PRACTICE OF MEDICINE, HOW REGULATED.

ARTICLE 1.

Practitioners.

§1477. *Who May Practice.*—No person shall practice medicine within this State, unless he has been heretofore legally authorized so to do, or shall be hereafter authorized so to do, by a diploma from an incorporated medical college, medical school, or university, or has, after attending one or more full terms at a regularly chartered medical college, been in active practice of medicine since the year 1866, or who was by law authorized to practice medicine in 1866, or shall have been licensed by the medical board.

§1478. *"Practice Medicine" Defined.*—For the purpose of this chapter the words "practice medicine" shall mean, to suggest, recommend, prescribe or direct, for the use of any person, any drug, medicine, appliance, apparatus, or other agency, whether material or not material for the cure, relief, or palliation of any ailment of disease of the mind or body, or for the cure or relief of any wound, fracture, or other bodily injury or any deformity, after having received or with the intent of receiving therefor, either directly or indirectly any *bonus*, gift or compensation.

§1479. *Practitioners Must Register.*—Every person lawfully engaged in the practice of medicine within this State, before commencing to practice, shall register in the office of the clerk of the Superior court of the county wherein he resides and is practicing, or intends to commence the practice of medicine, in a book to be kept for the purpose by said clerk, his name, residence, and place of birth, together with his authority for practicing medicine, as prescribed in this Chapter. The person so registering shall subscribe or verify, by oath or affirmation, before a person duly qualified to administer oaths under the laws of this State, an affidavit containing such facts, and whether such authority is by diploma or license, and the date of same, and by whom granted, which shall be exhibited to the county clerk before the applicant shall be allowed to register. The county clerk shall receive a fee of fifty cents for each registration, to be paid by the person so registering.

§1480. *Must Register Again on Removal.*—Any such registered physician in this State, who may change his residence from one county in this State, shall register within the clerk's office of the county to which he removes and wherein he intends to reside, and to practice medicine, as provided in the preceding section.

§1481. *Medical Officers Excepted.*—Nothing in this chapter shall apply to commissioned medical officers of the United States army or navy, or to the United States marine hospital service, or to legally qualified dentists in the practice of their profession, or to any woman practicing only midwifery.

Article 2.

Medical Board.

§1482. *Medical Board, How Appointed.*—The Governor shall appoint for this State three separate boards of medical examiners of five members each, as follows: One board to consist of five members of the regular school of medicine; one board of five members of the eclectic school of medicine; and one board of five members of the homeopathic school of medicine. The members of each of said boards shall be men learned in medicine and surgery, of good moral and professional character, and graduates of reputable medical colleges; but none of them shall be members of the faculty of any medical college. Each of said three boards shall be wholly independent of and separate from the other two in the performing of the duties herein required of each of said boards. A majority of each board shall constitute a quorum.

§1483. *Terms of Office.* . . .

§1484. *Oath of Office.* . . .

§1485. *Officers and Meetings.* . . .

Each board shall hold at least two regular meetings in each year. One meeting shall be held on or just before graduation day of each medical college now chartered, or that may hereafter be chartered, in this State, and the board of examiners, after consultation with the faculty of said college, shall fix a time for its meeting to suit a majority of the students graduating from said college; the other, on the second Tuesday in October. The meetings of each board may be held in such city as each board may determine for itself. Special meetings may be held upon the call of the president and two members of each board; but there shall not be less than two regular meetings in each year. Each board may prescribe rules, regulations and by-laws for its proceedings and government, and shall keep permanent record of its actions. And each board shall examine and pass upon the qualifications of applicants for the practice of medicine, in the State, as herein prescribed.

§1486. *Who May be Examined.*—It shall be the duty of each board, at any of its meetings, to examine only persons making applications to it, who are graduates of an incorporated medical college, school, or university, that requires not less than three full courses of study of six months each, who shall desire to commence the practice of medicine or surgery in the State, and who shall not by the provisions of this article be exempt from such examination; but any person now matriculated as a student of medicine at any medical college, after graduation, and any person from another State, who shall have graduated prior to April

1st, 1895, at a lawfully chartered medical college, requiring only two full courses of study, shall be eligible for examination and license: *Provided, always,* that the applicant for such examination shall hold a lawfully conferred diploma from an incorporated medical college which conforms to the system of practice represented by the board to which the application shall be made; unless the applicant desires to practice a different system from that recognized in his diploma, then he shall appear before the board which represents the system that he proposes to practice. But in no event shall an applicant who stands rejected by one of said boards be examined or licensed by either of the other boards. If the applicant desires to practice a system not represented by any of the boards hereby established, he may elect for himself the board before which he will appear for examination. When an applicant shall have passed an examination satisfactory as to proficiency before the board in session, the president thereof shall grant to such applicant a certificate to that effect. A fee of ten dollars shall be paid to such board through such officer or member as it may designate, by each applicant, before such examination is had. In case an applicant shall fail to pass a satisfactory examination before any board, he shall not be permitted to stand any further examination before any of the boards within the next three months thereafter. Nor shall he again have to pay the fee prescribed aforesaid for any subsequent examination;

Provided, that when, in the opinion of the president of any board, any applicant has been prevented by good cause from appearing before said board, the president and two members of said board designated by him shall constitute a committee, who shall examine such applicant and may, if they see fit, grant him a certificate which shall have the same force and effect as though granted by a full board, until the next regular meeting of the board, when, if the applicant fails to appear for examination, said certificate shall be void.

§1487. *Use of Fund Raised from Fees.* . . . .

§1488. *Certificate Must be Recorded.*—Before any person who obtains a certificate from any board, or from a committee of any board, may lawfully practice medicine or surgery in this State, he shall cause the said certificate to be recorded in the office of the clerk of the superior court in the county in which he resides. But if he does not reside in the State of Georgia, he shall cause said certificate to be recorded in any county within this State in which he offers to practice. The certificate shall be recorded by the clerk in a book kept for that purpose. It shall be indexed in the name of the person to whom the certificate is granted. The clerks' fee for recording a certificate shall be the same as for recording a deed.

1489. *Unlawful to Practice Without Complying with this Article.*—From and after the first day of January, 1895, it shall be unlawful for any person to commence the practice of medicine or surgery in this State without complying with the provisions of this Article. But nothing in this Article shall apply to persons then unlawfully engaged in the

practice of medicine or surgery in the State of Georgia, to any commissioned medical officer or contract surgeon of the United States army or navy or marine hospital service, in the performance of their duties as such, nor to any physician or surgeon residing in any State or Territory of the United States or in the District of Columbia, who may be *bona fide* called in consultation in a special case, with a legally qualified physician or surgeon residing in this State; nor shall this Article be construed as affecting or changing, in any way, laws in reference to license tax to be paid by physicians and surgeons: *Provided*, that a non-resident physician or surgeon called in consultation in a special case, as above prescribed, shall not be permitted to engage in continuous practice or consultation with any resident physician or surgeon under any form of contract or agreement, direct or indirect.

§1490. *Who May be Regarded as Practicing.*—Any person shall be regarded as practicing medicine or surgery, within the meaning of this Article, who shall prescribe for the sick or those in need of medicine or surgical aid, and shall charge or receive therefor money or other compensation or consideration, directly or indirectly; *Provided, however*, that midwives and nurses shall not be regarded as practicing medicine or surgery.

§1491. *Penalty.*—Any person who shall practice medicine or surgery in this State in violation of the provisions of this Article, shall, upon conviction, be punished as for a misdemeanor for each offense, and it shall not be lawful for him to recover compensation for service which may be claimed to have been rendered by him as such physician or surgeon.

HAWAII

Practice of Medicine and Surgery.

License is Required.

Section 827 P. L.—No person shall practice medicine or surgery as a profession in the Territory of Hawaii, either gratuitously or for pay or shall offer so to practice, or shall advertise or announce himself, either publicly or privately, as prepared or qualified so to practice, without having first obtained from the Treasurer under seal of his department a license in form and manner substantially as hereinafter set forth. Such license shall only be granted upon the written recommendations of the Board of Health.

Issued on the Recommendation of Board of Health.

All licenses to practice medicine or surgery heretofore granted by the Treasurer upon the recommendation of the Board of Health, and in force at the time of the passage of this Act, shall remain in force, subject to the provisions of this Act.

Defining the Practice of Medicine.

Section 828 P. L.—For the purposes if this Act the practice of medicine shall be held to include the use of drugs and medicines, water, electricity, hypnotism, or any means or method, or any agent, either tangible or intangible, for the treatment of disease in the human subject. Provided, however, that nothing herein contained shall be held to forbid any person from the practice of any method, or the application of any remedial agent or measure under the direction or with the approval of a licensed physician.

Medical Examiners.

Section 829 P. L.—No person shall be recommended by the Board of Health for a license to practice medicine or surgery except upon the written report of a Board of Medical Examiners, to be appointed and constituted as hereinafter provided, setting forth that the applicant named therein has been duly examined and found to be possessed of the necessary qualifications.

To be Appointed by Governor.

Section 830 P. L.—For the purpose of carrying out the provisions of this Act, the Governor is hereby authorized and directed to appoint a Board of Medical Examiners, whose duty it shall be to examine all

applicants for license to practice medicine or surgery, and to report the result of such examination to the Board of Health.

Such Board of Medical Examiners shall consist of three persons, all of whom shall be licensed physicians or surgeons under the laws of this Territory. . . . .

Applicant to Pay a Fee of $10.

Section 831 P. L.—No applicant for license to practice medicine or surgery shall be examined, until he shall have paid to the Treasurer a fee of Ten Dollars.

Penalty for Violating the Statute.

Section 832 P. L.—Any person who shall practice medicine or surgery in the Hawaiian Islands, or who shall offer or attempt to so practice, or shall advertise or announce himself, either publicly or privately, as prepared or qualified to so practice, contrary to the provisions of Section 827, shall be guilty of a misdemeanor, and shall be liable on conviction to a fine of not more than Two Hundred and Fifty Dollars in the discretion of the Court.

License Revocable.

Section 833 P. L.—Licenses to practice medicine and surgery, whether granted under the provisions of this Act or of any Act heretofore existing, may be revoked by the Treasurer at any time for unprofessional misconduct, gross carelessness or manifest incapacity; such misconduct, carelessness or incapacity, having been proved to the satisfaction of the Board of Health, and by that body reported in writing to said Treasurer. In case any license is revoked for any of the causes named in this Section, the holder thereof shall be immediately notified of such revocation in writing by the Treasurer.

Section 834 P. L.—In case of an alleged misconduct, carelessness or incapacity on the part of any holder of a license to practice medicine or surgery, the person so charged shall be notified in writing of the charge or charges that have been made, and of the time and place when and where evidence in support of the same will be heard, and shall have the opportunity to present evidence and be heard in his own defense.

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IDAHO

AN ACT TO REGULATE THE PRACTICE OF MEDICINE AND SURGERY WITHIN THE STATE OF IDAHO; AND PROVIDING PENALTIES FOR THE VIOLATION OF THIS ACT, AND THE REPEAL OF ALL OTHER ACTS IN RELATION THERETO.

Be it Enacted by the Legislature of the State of Idaho:

SECTION 1.—The Governor of the state, within sixty days from the expiration of the session of the legislature at which this act shall have been passed, shall appoint a board of medical examiners, to be known and styled, "The State Board of Medical Examiners," consisting of six members, a majority of whom shall never be appointed from, nor represent, any one school of medicine, and not less than three schools of medicine shall be at all times represented on said Board. . . . .

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SEC. 3.—. . . . Said board shall hold regular meetings on the first Tuesday in the months of April and October in each year at the capital of the state, or at such other places as the board shall designate. Special meetings may also be called, when in the opinion of the majority of the said board the same is necessary, and shall be held at such times and places as a majority of the board may designate. . . . .

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SEC. 6.—After the passage of this Act, every person, except as hereinafter provided, desiring to commence the practice of medicine and surgery, or either of them, within the state, shall, immediately and prior to commencing the same, make a written application to the state medical examining board, upon suitably prepared blanks, to be furnished by the board, for a license so to do. The applicant shall transmit with said application his or her diploma together with an affidavit setting forth that said diploma is genuine and that the applicant is the rightful possessor thereof and the identical person named therein, and that same was obtained by pursuing the regular course of study or examination in said institution, and setting forth that he or she is a citizen of the United States, or has declared their intention of becoming such. If the said diploma has been issued by a reputable college of medicine in good standing said applicant shall be eligible to examination. All applicants shall be examined in the applied branches of the theory and practice of medicine and surgery or either of them, as those branches are taught in the reputable chartered schools of the system of medicine to which the applicant belongs and which the

applicant intends to practice, and such examination shall in all cases include anatomy, physiology, pathology, diagnosis, hygiene, chemistry, histology and toxicology. No applicant for license shall be allowed to practice medicine and surgery or either of them until such license shall have been granted. The board shall cause the examination to be scientific and practical and sufficiently thorough to test the applicant's fitness to practice medicine and surgery, and if the applicant correctly answer at least seventy-five per cent of all the questions submitted, said board shall grant the applicant a license to practice medicine and surgery, or either of them, in this state. Every applicant for license under any of the provisions of this act, must furnish sufficient evidence to the board that they are of good moral character. All applications under this section must be accompanied by twenty-five ($25) dollars, which is the fee for examination under this section. Should the applicant fail to pass said examination, the fee is not returnable. The cost of transmission to and from the board of all papers belonging to an applicant under this or any other section of this act shall be paid by the applicant. In the case an applicant, for an examination fails to pass the required examination, he or she may be re-examined after the expiration of six months, and within one year, without the payment of an additional fee, and thereafter said applicant may be examined as often as desired at any regular or special meeting of the board on the payment of the regular fee for such examination. Said board may also refuse a license for unprofessional conduct, or conduct of a criminal, immoral, or dishonorable nature.

SEC. 7.—The words "unprofessional or dishonorable conduct" as used in section 6, or any other section of this Act, is hereby declared to mean:

First.—The procuring or aiding or abetting in procuring a criminal abortion.

Second.—The employment of what are popularly known as "cappers" or "steerers" in procuring practice.

Third.—The obtaining of a fee on the assurance that a manifestly incurable disease can be permanently cured.

Fourth.—A wilful betrayal of the professional secret to the detriment of the patient.

Fifth.—All advertisements of medical business in which untruthful and improbable statements are made.

Sixth.—All advertisements of any kind, of any medicine or means, whereby the monthly periods of women can be regulated or the menses can be re-established if suppressed.

Seventh.—Conviction of any offence involving moral turpitude.

Eighth.—Habitual intemperance in the use of ardent spirits, narcotics or stimulants.

SEC. 8.—All questions upon the different branches of medicine and surgery submitted by said board to candidates for examination shall either be written or printed, or partly written and printed, and the

questions on each branch shall be arranged upon separate sheets of paper and numbered consecutively.

The candidates shall be supplied with a list of the questions upon but one branch or subject at a time, which, after completing his or her answers thereto, he or she shall be entitled to the next list of questions, and so on in like manner until said candidate shall have been examined in all the branches required. All answers to the questions submitted shall be in writing, upon suitable paper furnished by the board, no candidate being permitted to furnish his or her own paper for such written answers. Each list of the candidate's answers must bear the same title as the corresponding list of questions, and each answer shall be numbered to correspond with the question to which it refers. The questions submitted by the board to each candidate examined, together with the answers thereto, shall be placed and kept on file in the office of the secretary of said board, and shall constitute part of the records of said office.

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SEC. 10.—Any person practicing medicine and surgery within this State, without having obtained the license herein provided for, or contrary to the provisions of this act, shall be deemed guilty of a misdemeanor, and upon conviction thereof, shall be fined in a sum of not less than fifty dollars, nor more than three hundred dollars, or by imprisonment in the county jail not less than ten days, nor more than six months, or by both such fine and imprisonment, in the discretion of the court, together with the costs of prosecution, and each day such person continues to practice medicine and surgery, contrary to the provisions of this act, shall constitute a separate offense.

SEC. 11.—Every person receiving a license under this act shall, within thirty days thereafter, have the same recorded in the office of the county recorder, within the county where the licentiate intends to practice. Otherwise, said license is void. The county recorder of each county shall have suitably prepared, a separate "book of record", in which all the licenses under this act, presented to them, shall be recorded, and on the first day of December of each year, furnish the Secretary of "State Medical Examining Board" a list of the licenses on record in his office, and upon notice to him from said secretary of the revocation of any license on record in his office, or of the death or removal from the county, of any person whose license is on record therein, said recorder shall make a note of the fact on the page containing the record of said license, so that the records kept by the said county recorder shall correspond with the records of his county, as kept by the secretary of said medical board.

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SEC. 13.—The words "respectable or reputable medical college or university in good standing" are hereby declared to mean such

medical colleges or universities as are legally chartered, reputable, and in good standing within the state or county where they are located.

SEC. 14.—Any person shall be regarded as practicing medicine and surgery, or either, who shall advertise in any manner, or hold himself or herself out to the public as a physician and surgeon, or either, in this state, or who shall investigate or diagnosticate or offer to investigate or diagnosticate any physical or mental ailment of any person with a view of relieving the same as is commonly done by physicians and surgeons, or suggest, recommend, prescribe, or direct, for the use of any person, sick, injured or deformed, any drug, medicine, means or appliance for the intended relief, palliation or cure of the same, with the intent of receiving therefor, either directly or indirectly, any fee, gift or compensation whatsoever; *Provided, however:* This act shall not apply to dentists and registered pharmacists or midwives in the legitimate practice of their respective professions, nor to services rendered in cases of emergency, where no fee is charged. Any person who shall present to the board, as his or her own, the diploma of another, or a forged affidavit of identification, or who shall attempt to personate another practitioner of a like or different name, shall, upon conviction thereof, be subject to such fine and imprisonment as are made and provided by the statutes of the State of Idaho for the crime of forgery.

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SEC. 16.—This act shall not apply to commissioned medical officers of the United States army, navy and marine hospital service in the discharge of their official duties, nor to railway surgeons in the discharge of official duties, nor to legally qualified physicians and surgeons from other states, when called in consultation with any legally qualified physician and surgeon of this state.

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SEC. 19.—All other acts and parts of acts regulating the practice of medicine and surgery in this State are hereby repealed.

SEC. 20.—Whereas, an emergency is hereby declared to exist, this bill shall be in force and take effect from and after its passage and approval by the Governor.

Approved on the 3rd day of March, 1899.

ILLINOIS

Laws of 1899, Page 273.

An Act to Regulate the Practice of Medicine in the State of Illinois and to Repeal an Act Therein Named.

§1.—. . . . .

§2.—No person shall hereafter begin the practice in medicine or any of the branches thereof, or midwifery in this state without first applying for and obtaining a license from the state board of health to do so. Application shall be made in writing and shall be accompanied by the examination fees hereinafter specified, and with proof that the applicant is of good moral character. Applications from candidates who desire to practice medicine and surgery in all their branches shall be accompanied by proof that the applicant is a graduate of a medical college or institution in good standing, as may be determined by the board. When the application aforesaid has been inspected by the board and found to comply with the foregoing provisions to board shall notify the applicant to appear before it for examination at the time and place mentioned in such notice.

Examinations may be made in whole or part in writing by the board, and shall be of a character sufficiently strict to test the qualifications of the candidate as a practitioner. The examination of those who desire to practice medicine and surgery in all their branches shall embrace those general subjects and topics, a knowledge of which is commonly and generally required of candidates for the degree of doctor of medicine by reputable medical colleges in the United States. The examination of those who desire to practice midwifery shall be of such character as to determine the qualification of the applicant to practice midwifery. The examination of those who desire to practice any other system or science of treating human ailments who do not use medicines internally or externally, and who do not practice operative surgery shall be of a character sufficiently strict to test their qualifications as practitioners.

All examinations provided for in this act shall be conducted under rules and regulations prescribed by the board, which shall provide for a fair and wholly impartial method of examination: *Provided*, that graduates of legally chartered medical colleges in Illinois in good standing as may be determined by the board may be granted certificates without examinations.

§3.—If the applicant successfully passes his examination, or presents a diploma from a legally chartered medical college in Illinois of good standing, the board shall issue to such applicant a license authorizing

him to practice medicine, midwifery or other system of treating human ailments, as the case may be: *Provided*, that those who are authorized to practice other systems cannot use medicine internally or externally or perform surgical operations: *Provided further*, that only those who are authorized to practice medicine and surgery in all their branches shall call or advertize themselves as physicians or doctors: and *Provided further*, that those who are authorized to practice midwifery shall not use any drug or medicine or attend other than cases of labor. Such license shall be in such form as may be determined by the board, and in accordance with the provisions of this act: *Provided*, however that any wilful violation on the part of an applicant of any of the rules and regulations of the board governing examinations shall be sufficient cause for the board to refuse to issue a license to such applicant. Such certificates shall be signed by all members of the board and attested by the Secretary.

§4.—Every person holding a certificate from the State Board of Health shall have it recorded in the office of the clerk of the county in which he resides or practices within three months from its date, and the date of recording shall be endorsed thereon. Until such certificate is recorded as herein provided, the holder thereof shall not exercise any of the rights or privileges conferred therein. Any person practicing in another county shall record the certificate in like manner in the county in which he practices, and the holder of the certificate shall pay to the county clerk the usual fee for making the record. The county clerk shall keep, in a book provided for the purpose, a complete list of the certificates recorded by him, with the date of the issue of the certificate. The register of the county clerk shall be open to public inspection during business hours.

§5.—The fees for examination and for a certificate shall be as follows: Ten (10) dollars for examination in medicine and surgery, and five (5) dollars for a certificate if issued. Five (5) dollars for an examination in midwifery, and three (3) dollars for a certificate if issued. For all other practitioners ten (10) dollars for an examination and five (5) dollars for a certificate if issued.

§6.—The State Board of Health may refuse to issue the certificates provided for in this act to individuals who have been convicted of the practice or criminal abortions, or who have by false or fraudulent representation obtained or sought to obtain practice in their profession, or by false and fraudulent representation of their profession have obtained or sought to obtain money or other thing of value, or who advertise under names other than their own, or for any other unprofessional or dishonorable conduct, and the board may revoke such certificates for like causes: *Provided*, that no certificates shall be revoked or refused until, the holder or applicant shall be given a hearing before the board.

§7.—Any person shall be regarded as practicing medicine, within the meaning of this act, who shall treat or profess to treat, operate on or prescribe for any physical ailment or any physical injury to,

or deformity of, another: *Provided*, that nothing in this section shall be construed to apply to the administration of domestic or family remedies in cases of emergency, or to the laws regulating the practice of dentistry or of pharmacy. And this act shall not apply to surgeons of the United States army, navy or marine hospital service in the discharge of their official duties, or to any person who ministers to or trusts the sick of suffering by mental or spiritual means, without the use of any drug or material remedy.

§8.—That any itinerant vender of any drug, nostrum, ointment or appliance of any kind intended for the treatment of disease or injury, who shall, by writing or printing, or any other method, profess to the public to cure or treat disease or deformity by any drug, nostrum or application, shall pay a license of one hundred dollars ($100.00) per month into the treasury of the board, to be collected by the board in the name of the People of the State of Illinois, for the use of said board. And it shall be lawful for the State Board of Health to issue such license on application made to said board, said license to be signed by the president of the board and attested by the secretary with the seal of the board; but said board may, for sufficient cause, refuse said license. Any such itinerant vender who shall, by writing or printing, or any other method, profess to cure or treat disease or deformity by any drug, nostrum or appliance, without a license so to do, shall be deemed guilty of a violation of this section, and upon conviction shall be subject to the penalties hereinafter provided.

§9.—Any person practicing medicine or surgery or treating human ailments in the state without a certificate issued by this board in compliance with the provision of this act, or any itinerant vender violating the provisions of Section 8 of this act, shall, for each and every instance of such practice or violation, forfeit and pay to the People of the State of Illinois, for the use of the said board of health, the sum of one hundred (100) dollars for the first offense and two hundred (200) dollars for each subsequent offense, the same to be recovered in an action of debt before any court of competent jurisdiction, and any person filing or attempting to file as his own the diploma or certificate or another, or a forged affidavit of identification, shall be guilty of a felony, and upon conviction shall be subject to such fine and imprisonment as are made and provided by the statutes of the State for a crime of forgery: *Provided* that this section shall not apply to physicians who hold unrevoked certificates from the State Board of Health, issued prior to the time of the taking effect of this act.

Approved April 24, 1899.

LAWS OF 1907. PAGE 378.

An Act to amend "An Act to Regulate the Practice of Medicine in the State of Illinois, and to Repeal an Act Therein Named," Approved April 24, 1899, in force July 1,1899, by adding three new sections to said Act, to be known as Section 2a, Section 3a and Section 3b.

§1.—*Be it enacted by the People of the State of Illinois, represented in the General Assembly:* That an act entitled "An Act to regulate the practice of medicine in the State of Illinois, and to repeal an act therein named" Approved April 24, 1899, in force July 1, 1899, be amended by adding three new sections to be known as section 2a, section 3a and section 3b, to read as follows:

§2a.—The State Board of Health shall be empowered to establish a stanard of preliminary education deemed requisite to admission to a medical college in "good standing," and to require satisfactory proof to the enforcement of this standard by medical colleges, provided that the board shall not recognize examinations of applicants for admission to medical colleges that have not been conducted by the faculty or officers of a medical college. The board shall also be empowered to determine the standing of literary or scientific colleges, high schools, seminaries, normal schools, preparatory schools, and the like, and the board may, in its discretion, accept as the equivalent of one or more of the sessions or terms prescribed in the requirements governing medical colleges in "good standing" attendance in a literary or scientific college in "good standing" as evidenced by a degree from said institution, providing that the standards of said literary or scientific college are fully equal to those of the State University of Illinois.

§3a.—The State Board of Health may, in its discretion, issue a license, without examination, on the payment of the proper fee, to a physician who is a graduate of a medical college in good standing, and has been licensed in any county (country), state or territory, in which the requirements of medical registration are deemed by the State Board of Health to have been practically equivalent to the requirements of medical registration in force in Illinois, under the provisions of the Act to which this Act is an amendment: *providid,* that such country, state or territory shall accord a like privilege to physicians who hold licenses issued by the Illinoi State Board of Health. And the State Board of Health may also, in its discretion, issue a license, without examination, to a physician who is a graduate of a medical college in good standing, and has passed an examination before the United States Army, the United States Navy, or the United States Public Health and Marine Hospital Service.

§3b.—. . .

Approved June 4, 1907.

INDIANA

Statutes Revision of 1908. Chapter 101.

8400. *License to Practice Medicine*—1.—That it shall hereafter be unlawful for any person to practice medicine, surgery or obstetrics in this state without first obtaining a license so to do, as hereinafter provided.

8401. *Certificate From Medical Board—Examinations—Fees*—2.—After this law goes into effect any person desiring to begin the practice of medicine, surgery or obstetrics in this state, shall procure from the state board of medical registration and examination a certificate that such person is entitled to a license to practice medicine, surgery and obstetrics in the state of Indiana; and in order to procure such certificate the applicant shall submit to the state board of medical registration and examination his diploma, with an affidavit setting forth the time and numbers of terms, duration of each term, applicant was required to be in attendance at said school in order to complete said course of study, and that the affiant is the person to whom such diploma was issued. Such application shall be accompanied by the affidavit of two freeholders resident in the same county in which the applicant resides, stating that the applicant is the person named in the accompanying diploma and application for a certificate. All diplomas received by the board shall be returned to the person owning the same, and for failure to return any diploma to its lawful owner within a reasonable time the secretary of said board shall be liable on his bond for damages in the sum of twenty-five dollars. Such applicant shall pay to said board the sum of ten dollars ($10.00) at the time of making such application. All persons who were practicing medicine, surgery and obstetrics in the state of Indiana on March 8, 1897 and have not complied with the provisions of the law, and desiring to continue the same, shall, on or before July 11, 1899, obtain a certificate that they are entitled to do so by presenting to the state board of medical registration and examination the license possessed by them at the time of the passage of this law, together with an affidavit that they are the legal possessors of the same, and the persons mentioned therein, and such applicant shall pay to the board the sum of one dollar ($1.00) at the time of making such application. The board shall thereupon issue to such applicant a certificate which, when presented to the county clerk of the proper county, shall entitle the hoder to a license to practice medicine, surgery and obstetrics in the state of Indiana. In the event an applicant for a certificate from the state board of medical registration and examination shall present a diploma from a medical college which is not recognized as maintaining a sufficiently high grade or standard of medical education as defined and

fixed in the records of the board, the applicant shall have the privilege of being examined as to his qualifications to practice medicine, surgery and obstetrics, in such manner as the board shall provide. And if he shall pass an examination satisfactory to the board he shall receive a certificate, the same as if he had presented a satisfactory diploma and other evidences of qualifications for the practice of medicine. But if he should fail to pass such examination he shall be permitted to submit to another examination within twelve months from the time of the first examination. He shall pay to the state board of medical registration and examination the sum of twenty-five dollars ($25.00): *Provided, however,* That payment of said sum of twenty-five dollars ($25.00) shall entitle him to a re-examination in case of failure at the first or any subsequent examination: and *provided further,* That if such applicant shall fail to pass the examination prescribed by such board of medical registration and examination, he shall have the right to an appeal to the circuit or superior court of the proper county, requiring such board to show cause why such applicant should not be permitted to practice medicine, surgery or obstetrics in the state of Indiana, upon the applicant giving a good and satisfactory bond to be approved by the Court, to secure all costs of suit should the appeal be determined against him. Upon the receipt of the certificate by the applicant from the state board of medical registration and examination the applicant shall, upon the presentation therefor to the clerk of the county, in which he resided, receive from the county clerk a license to practice medicine, surgery and obstetrics within the state of Indiana. The person receiving such license shall pay to the county clerk fifty cents (50c) as his fee for issuing and recording such license as hereinafter provided. In case of change of residence from one county to another within this state, the holder of a physician's license shall obtain a new license in the county where he proposes to reside, by filing with the county clerk the license obtained by him in the county in which he last resided, in the same manner as provided for on the presentation of his certificate from the state board of medical registration and examination, and the clerk shall issue him a new license.

As amended, Acts 1899, page 247.

8402. *Form of License—List of Licenses*—3.—It shall be the duty of the clerk of the county in which an applicant resides to issue to the person presenting such certificate, as hereinbefore provided for, a license under his official seal in the following form:

State of Indiana, County of.....ss:

I, ..., clerk of the circuit court of.....county, in the state of Indiana, do hereby certify that.....has complied with the laws of the State of Indiana relating to the practice of medicine, surgery and obstetrics, in the county and state aforesaid.

Witness my hand and seal of said court this.....day of.....189..

.....Clerk.

The county clerk shall enter on record the name, age, place and birth, address, school system of medcine to which said applicant belongs, and the person so registering shall subscribe to and verify by oath before such clerk an affidavit concerning such facts, which, if willfully false, shall subject the affiant to conviction for perjury. The county clerk shall furnish annually, on the first day of January, to the state board of medical registration and examination, upon blanks furnished by said board, a duplicate list of all certificates received and licenses issued by him during the preceding year, and shall include therein the date of issue, of said license, and the name, age and residence of the person receiving the same.

8403. *State Board—Appointment—Terms—Vacancies*—4.—. . . .

ACTS 1905, PAGE 194, IN FORCE APRIL 15, 1905.

8404. *Number of Members—New Members—Osteopathist*—1.—That within sixty days after this law goes into effect, it shall be the duty of the governor to appoint an additional member of the state board of medical registration and examination, which board shall thereafter consist of six members, each of whom shall serve as heretofore for a term of office for four years, and until his successor shall have been appointed and qualified. The additional member so appointed shall be a reputable practicing physician and a graduate of a reputable school or college of the system by which he practices, and shall belong to some school or system of practice other than those which are now represented upon said board, and his successor shall in the future always be of some school different from that of the remaining members of the board: Provided, That any osteopathist now practicing in and a resident of the state of Indiana and holding a diploma from a reputable college of osteopathy, as determined by the state board of medical registration and examination shall be eligible to an examination on proper application to the said board, and should he pass this examination, that he shall be granted a certificate for a license forthwith to practice osteopathy in the State of Indiana.

8405. *Duties of Board—Pay—Officers, Meetings—Bonds—Revocation of License.*—. . . . The said board shall hold regular meetings on the second Tuesday in January and July of each year, and as often in addition as may be necessary. . . . .

The board at its discretion may authorize the secretary to issue a temporary permit to an applicant for the iterim from date of application until the next regular meeting of the board. . . .

8406. *Reports Printed*—3.—. . . .

8407. *Midwives—Application—Fee—Certificate—License*—6.— . . . .

8408. *Exemptions from Act*—7.—Nothing in this act shall be (so) construed as to discriminate against any school or system of medicine, or to prohibit gratuitous services in cases of emergency, or to the administration of family remedies. This act shall not apply to any commissioned officer of the United States army, navy or marine,

hospital service in the discharge of his official duties, nor to any physician or surgeon who is legally qualified to practice in the state or territory in which he resides when in actual consultation with a legal practitioner of this state, nor to any physician or surgeon residing on the border of a neighboring state and duly authorized to practice under the laws thereof, whose practice extends into the limits of this state: *Provided*, That such practitioner shall not open an office or appoint a place to meet patients or receive calls within the limits of this state. This act shall not be construed to prevent medical students from practicing medicine and surgery under the immediate and direct supervision of a licensed physician for a limited period of two years: *Provided, however*, That the said student had not practiced medicine, surgery or obstetrics prior to the passage of this act; in that event the amount of time said student had practiced medicine, surgery or obstetrics shall be deducted from the said two years herein mentioned; and in no event shall the said student open an office or offer to engage in the practice of medicine, surgery or obstetrics. Any person violating any of the provisions of this section shall be deemed guilty of a misdemeanor, and on conviction thereof shall subject the offender to a fine of not less than twenty-five dollars ($25.00) not more than two hundred dollars ($200.00).

As amended, Acts 1899, page 247.

8409. *Practice of Medicine Defined*—8.—. . . .

To open an office for such purpose or to announce to the public in any way, a readiness to practice medicine in any county of the state or to prescribe for, or to give surgical assistance to, or to heal, cure or relieve, or to attempt to heal, cure or relieve those suffering from injury or deformity, or disease of mind or body, or to advertise, or to announce to the public in any manner a readiness or ability to heal, cure or relieve those who may be suffering from injury or deformity, or disease of mind or body, shall be to engage in the practice of medicine within the meaning of this act: *Provided*, That nothing in this act shall be construed to apply or to limit in any manner the manufacture, adveritsement or sale of proprietary medicines. It shall also be recorded as practicing medicine within the meaning of this act, if any one shall use in connection with his or her name the words or letters, "Dr." "Doctor," "Professor," "M. D." or "Healer," or any other title, word, letter or designation intending to imply or designate him or her as a practitioner of medicine or surgery in any of its branches: *Provided*, That this act shall not be construed to apply to non-itinerant opticians who are at this time engaged in or who may hereafter engage in the practice of optometry in this state, nor to professional or other nurses.

In charging any person in an affidavit, information or indictment with a violation of this law by practicing medicine, surgery or obstetrics without license, it shall be sufficient to charge that he did, upon a certain day and in a certain county, engage in the practice of medicine, he not having any license to do so, without averring any further or more particular facts concerning the same.

As amended, Acts 1901, page 475.

8410. *Penalty for Violating Act.*—9.—Any person who shall practice medicine, surgery or obstetrics in this state without having a license duly issued as hereinbefore provided, shall be deemed guilty of a misdemeanor, and on conviction thereof shall be fined not less than twenty-five dollars ($25.00) nor more than two hundred dollars ($200.00).

8411. *Osteopathy, License.* . . . .

IOWA

Codes 1897 and Supplement 1902, Title XII, Chap. 17, Of the Practice of Medicine.

2576. *Board of Medical Examiners—Examinations—Certificates.*—The state board of medical examiners shall consist of the physicians of the state board of health, and the secretary of the board shall be secretary thereof. It shall hold regular meetings in May and November and special ones as may be necessary, due notice thereof being given, at which it shall discharge the duties contemplated by this chapter. All examinations shall be in writing, each candidate for examination in any school of medicine being given the same set of questions, covering anatomy, physiology, general chemistry, pathology, surgery and obstetrics. In materia madica, therapeutics and the principles and practice of medicine, a set of questions shall be used corresponding to the school of medicine which the applicant desires to practice. The examination papers, when concluded, shall be marked upon a scale of one hundred, each candidate for examination first to pay to the secretary of the board a fee of ten dollars therefor. The average required to pass shall be fixed by the board prior to the examination. Each applicant shall, upon obtaining an order for examination, receive from the secretary a confidential number which he shall place upon his work when completed, so that the board, in passing thereon, shall not know by whom it was prepared. All matters connected therewith shall be filed with the secretary and preserved for five years as a part of the records of the board, during which time they shall be open to public inspection. If the examination is satisfactory to five members of the board, it shall issue its certificate, under its seal, signed by the president, secretary, and not less than three other members, who may, in the absence of the others, act as an examining board, and the different schools of medicine represented in the board of health shall be represented in said number. The certificate, while in force, shall confer upon the holder the right to practice medicine, surgery and obstetrics, and be conclusive evidence thereof. In all examinations made or proceedings had pursuant to the provisions of this chapter, any member of the board may administer oaths and take testimony in any manner authorized by law. Any one failing in his examination shall be entitled to a second one, within three months thereafter, without further fee. If any person shall by notice in writing apply to the secretary of the board for an examination or a re-examination, and it fails or neglects for three months thereafter to give him the same, he may, notwith-

standing any provision of this chapter, practice medicine until the next regular meeting of the board without the required certificate.

2577. *Recording Certificate.*—Every certificate issued under this chapter shall show whether it was granted upon examination or diploma, and the school of medicine the holder practices under. He shall, before engaging in the practice of medicine, file the same for record in the office of the recorder of the county in which he resides, who shall record it in a book provided for that purpose, which record shall be open to public inspection, and for which service the recorder may charge a fee of fifty cents, to be paid by the certificate holder. The same record must be made of the certificate in any county to which the holder may remove and in which he proposes to practice.

2578. *Repealed. See law* 1907 *below.*

2579. *Who Deemed Practitioner.*—Any person shall be held as practicing medicine, surgery or obstetrics, or to be a physician, within the meaning of this chapter, who shall publicly profess to be a physician, surgeon or obstetrician, and assume the duties, or who shall make a practice of prescribing or of prescribing and furnishing medicine for the secretary, or who shall publicly profess to cure or relieve; but it shall not be construed to prohibit students of medicine, surgery or obstetrics, who have not had less than two courses of lectures in a medical school of good standing, from prescribing under the supervision of preceptors, or gratuitous service in case of emergency, nor to prevent the advertising, selling or prescribing natural mineral waters coming from wells or springs, nor shall it apply to surgeons of the United States army or navy, nor of the marine hospital service, nor to physicians or midwives who have obtained from the board of examiners a certificate permitting them to practice medicine, surgery or obstetrics without a diploma from a medical school or examination by the board, nor to physicians, as defined herein, who have been in practice in this state for five consecutive years, three years of which time shall have been in one locality, nor to filling prescriptions by a registered pharmacist, nor to the advertising and sale of patent or proprietary medicines.

2580. *Penalties.*—Any person who shall present to the board of medical examiners a fraudulent or false diploma, or one of which he is not the lawful owner, for the purpose of procuring a certificate as herein provided, or shall file, or attempt to file, with the recorder of any county in the state the certificate of another as his own, or who shall falsely personate any one to whom a certificate has been granted by such board, or shall practice medicine, surgery or obstetrics in the state without having first obtained and filed for record the certificate herein required, and who is not embraced in any of the exceptions contained in this chapter, or who continues to practice medicine, surgery or obstetrics after the revocation of his certificate, is guilty of a misdemeanor, and, upon conviction thereof, shall be fined not less than three hundred dollars, nor more than five hundred dollars, and costs of prosecution, and shall stand committed to the county jail until such fine is

paid; and whoever shall file or attempt to file with the recorder of any county in the State the certificate of another with the name of the party to whom it was granted or issued erased, and the claimant's name inserted, or shall file or attempt to file with board of medical examiners any false or forged affidavit of identification, shall be guilty of forgery.

2581. *Itinerant Physician.*—Every physician practicing medicine, surgery or obstetrics, or professing or attempting to treat, cure or relieve diseases, ailments or injuries by any medicine, appliance or method, who, by himself, agent or employee goes from place to place, or from house to house, or by circulars, letters or advertisements solicits persons to meet him for professional treatment at places other than his office at the place of his residence, shall be considered an itinerant physician; and such itinerant physician shall, in addition to the certificate elsewhere provided for in this chapter, procure from the state board of medical examiners a license as an itinerant, for which he shall pay to the treasurer of the state, for use of the state of Iowa, the sum of two hundred and fifty dollars per annum. Upon payment of this sum, the secretary shall issue to the applicant therefor a license to practice within the state, as an intinerant physician, for one year from the date thereof. The board may, for satisfactory reasons, refuse to issue such license, or may cancel such license upon satisfactory evidence of incompetency or gross immorality. Any person practicing medicine as an itinerant physician, as herein defined, without having procured such license shall be guilty of a misdemeanor, and, upon conviction thereof, shall be fined not less than three hundred dollars, nor more than five hundred dollars, and costs, and shall be committed to the county jail until such fine be paid: *Provided*, however, that nothing herein shall be construed to prevent any physician otherwise legally qualified from attending patients in any part of the state to whom he may be called in the regular course of business, or in consultation with other physicians.

2582. *Examination and Diploma Required.*—From and after Jan. 1, 1899, persons beginning the practice of medicine in the state or Iowa must submit to an examination as set forth in this chapter, and, in addition thereto, shall present diplomas from medical colleges recognized as in good standing by the state board of medical examiners, and all persons receiving their diplomas subsequent to January 1, 1899, shall present evidence of having attended four full courses of study of not less than twenty-six weeks each, no two of which shall have been given in any one year. The state board of medical examiners shall examine the graduates of the medical departments of the state university of Iowa and all such other medical colleges in this state as are recognized by said board of medical examiners as being in good and legal standing at the annual medical commencement and at the location of said state university and other medical colleges respectively.

2583. *Fees—Compensation—Expenses of Board.*—. . . .

Laws of 1904. Chapter 102.

An Act to amend the law as it appears in section two thousand five hundred eighty-two (2582) of the code supplement, and to provide for registering, without examination, physicians registered in other states.

Be it enacted by the General Assembly of the State of Iowa.

§1. *Registration Fee.*—That the law as it appears in section two thousand five hundred eighty-two (2582) of the code supplement be, and the same is hereby amended by adding thereto the following:

"(a) a certificate of registration showing that an examination has been made by the proper board of any state, on which an average grade of not less than seventy-five (75) percent was awarded, the holder thereof having been at the time of said examination the legal possessor of a diploma from a medical college of good standing in this state, may be accepted in lieu of an examination, as evidence of qualification. But in case the scope of said examination was less than that prescribed by this state, the applicant may be required to submit to a supplemental examination in such subjects as have not been covered.

"(b) a certificate of registration or license, issued by the proper board of any state, may be accepted as evidence of qualification for registration in this state, provided the holder thereof was, at the time of such registration, the legal possessor of a diploma issued by a medical college in good standing in this state, and that the date thereof was prior to the legal requirements of the examination test in this state. The fee for such examination shall be fifty dollars."

§2. *Restrictions.*—If, by the laws of any state or the rulings or decisions of the appropriate officers or boards thereof, any burden, obligation, requirements, disqualification, or disability is put upon physicians registered in this state or holding diplomas from medical colleges in this state, which are in good standing therein, affecting the right of said physicians to be registered or admitted to practice in said state, then the same or like burdens, obligations, requirements, disqualification, or disability shall be put upon the registration in this state of physicians registered in said state, or holding diplomas from medical colleges situated therein.

§3. *In Effect.*—This act, being deemed of immediate importance, shall take effect and be in force from and after its publication in the Register and Leader and the Des Moines Daily Capital, newspapers published in Des Moines, Iowa.

Approved March 15, A. D. 1904.

Laws of 1907. Chapter 141.

An Act to repeal section two thousand five hundred seventy-eight (2578) of the code and to enact a substitute therefor, relating to the revocation of physician's certificates.

Be it enacted by the General Assembly of the State of Iowa.

§1. *Repealed—Refusal of Certificate or Revocation for Cause.*—That

section 2578 of the code be and the same is hereby repealed and the following is enacted in lieu thereof:

"The board of Medical examiners may refuse to grant a certificate to any person otherwise qualified and shall revoke any certificate issued by it to any physician who is not of good moral character, or who solicits professional patronage by agents, or who profits by the acts of those representing themselves to be his agents, or who is guilty of fraudulent representations as to his skill and ability, or who is guilty of gross unprofessional conduct, or for incompetency, or for habitual intoxication or drug habit; or if the certificate has been granted upon false and fraudulent statements as to graduation or length of practice, the board of medical examiners shall, to safeguard the public health, revoke the certificate in the manner hereinafter set forth.

"§2. *Revocation of Certificate—Procedure.*—Before the revocation of any certificate issued by the state board of medical examiners the licentiate shall have been afforded an opportunity for a hearing before the board. At least twenty (20) days prior to the date set forth for such a hearing, the secretary of the state board of medical examiners shall cause written notice to be personally served upon the defendant in the manner prescribed for the serving of original notice in civil actions. Said notice shall contain a statement of the changes and the date and place set for the hearing before the board. If the party thus notified fails to appear, either in person or by counsel at the time and place designated in said notice, the board shall, after receiving satisfactory evidence of the truth of the charges and the proper issuance of notice, revoke said certificate. If the licentiate appear either in person or by counsel, the board shall proceed with the hearing as herein provided. The board may receive and consider affidavits and oral statements and shall cause stenographic reports of the original testimony to be taken, which, together with all other papers pertaining thereto, shall be preserved for two years. If five members of the board, present at the hearing, are satisfied that the licentiate is guilty of any of the offenses charged, the license shall be revoked. After the revocation of a certificate the holder thereof shall not practice medicine, surgery or obstetrics in this state, for such times as the state board of health may determine.

"§3. *Appeal.*—Any person aggrieved by any ruling or order entered under the provisions of this act shall have the right of an appeal to the district court in the county where the alleged offense was committed, upon giving notice to the board of medical examiners of such appeal within twenty days after the entry of such ruling, order, or judgment."

Approved April 4, A. D. 1907.

KANSAS

EXTRACTS FROM THE MEDICAL LAWS OF KANSAS, 1901, CHAPTER 254.

6671. SEC. 3.—*Applications and Certificates.*—All persons intending to practice medicine, surgery or osteopathy after the passage of this act, and all persons who shall have complied with section 2 of this act, shall apply to said board at any regular meeting, or at any other time or place as may be designated by the board, for a license. Application shall be made in writing, and shall be accompanied by the fee hereinafter prescribed, together with the age and residence of the applicant, proof that he or she is of good moral character, and satisfactory evidence that he or she has devoted not less than three periods of six months each, no two within the same twelve months, or, if after April 1, 1902, four periods of not less than six months each, no two in the same twelve months, to the study of medicine and surgery. All such candidates, except as hereinafter provided, shall submit to an examination of a character to test their qualifications as practitioners of medicine or surgery, and which shall embrace all those topics and subjects a knowledge of which is generally required by reputable medical colleges of the United States for the degree of doctor of medicine; *provided*, that the examination in materia medica and therapeutics and in the theory and practice of medicine shall be conducted by those members only of the board who are of the same school of practice as the applicant claims to follow; *provided, further* that graduates of legally chartered medical institutions of the United States or foreign countries in good standing, as determined by the board, may be, at the discretion of the board, granted a license without examination; *provided further*, that any graduate of a legally chartered school of osteopathy, wherein the requirements for the giving of a diploma shall include a course of instruction of not less than four terms of five months each, in two or more separate years, shall be given a certificate of license to practice osteopathy upon the presentation of such diploma; *provided further*, that the board may in its discretion accept, in lieu of examination or diploma, the certificate of the board of registration and examination of any other state or territory in the United States or any foreign country whose standards of qualification for practice are equivalent to those of this state; *provided*, that a temporary certificate may be issued to any student of medicine or practitioner of medicine who is not qualified under the law, upon the written request of a majority of the practitioners of medicine under this act in the county in which he or she desires to practice, or, if there be no practitioners registered under this act in any county in this state, the board

shall issue a temporary permit to persons as above described upon the application of the board of county commissioners of said county.

6672. SEC. 4.—*Record of Certificate.*—Upon the completion of the examination or the acceptance of the diploma or certificate as herein provided, the said board shall, if it finds the applicant qualified, grant and issue a certificate to said applicant to practice medicine and surgery within this state, and which shall be signed by the president and secretary and attested by the seal of the board. Within thirty days of the date of any certificate of license having been granted and issued by the board, the owner thereof shall have it recorded as hereinafter provided in the office of the clerk of the county in which he resides, or, if a nonresident of this state, that of the county in which he has an office or intends to practice, and the date of recording shall be indorsed thereon; and until such certificate or license is recorded he shall not exercise any of the rights or privileges therein conferred. The county clerk shall keep in a book for the purpose a complete list of the certificates recorded by him, which book shall be open to public inspection during business hours. Between the 1st and 20th days of December in each year, the county clerk shall furnish the secretary of the board a list of all certificates recorded and in force, and also a list of all certificates which have been revoked or the owners of which have removed from the county or died during the year. The fee for the recording and reporting of such certificates shall not exceed one dollar.

6673. SEC. 5.—*Fees.*—The fee for the issuance of a certificate to all those found qualified to practice medicine, surgery or osteopathy without examination, as provided under section 2, shall be two dollars. The fee for examination shall be fixed by the board, but shall not exceed fifteen dollars. The fee for examination of diploma or certificate from an examining board of another state shall also be fixed by the board, but shall not exceed ten dollars. . . . .

6674. SEC. 6.—*"Practicing" Defined.*—Repealed and replaced by Section 1, Chapter 63, Laws of 1908. *See below.*

6675. SEC. 7.—*Penalty.*—From and after the 1st day of September, 1901, any person who shall practice medicine and surgery or osteopathy in the state of Kansas without having received and had recorded a certificate under the provisions of this act, or any person violating any of the provisions of this act, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall pay a fine of not less than fifty dollars nor more than two hundred dollars for each offense; and in no case wherein this act shall have been violated shall any person so violating receive compensation for services rendered. It shall be the duty of the secretary of the state board of registration and examination to see that this act is enforced.

6676. SEC. 8.—*Perjury.*—Any person who shall swear falsely in any affidavit or oral testimony made or given by virtue of the provisions of this act or the regulations of said board of registration shall be deemed guilty of perjury.

6677. Sec. 9.—*Repeal.*—Chapter 68 of the Session Laws of 1870 is hereby repealed.

Laws of 1903. Chapter 358.

§1. *Temporary Permit.*—That the secretary of the state board of medical registration may in his discretion issue a temporary permit to practice medicine, surgery, osteopathy, to any person who shall have made application in writing to said board for license to practice, accompanied by the prescribed fee, and proof as required by Sec. 3 of chapter 254 of the Session Laws, of 1901, and who shall be a graduato of any legally chartered medical institution of the United States or any foreign country, or any legally chartered school of osteopathy; or such permit may be so issued to any such applicant for license, complying with said conditions, who is shown to have been licensed by the board of registration and examination in any other state or territory of the United States or any foreign country whose standards of qualifications for practice are equivalent to those of this state. Any such temporary permit so issued shall, when recorded in the office of the county clerk in which he resides, authorize the person receiving the same to practice medicine, surgery or osteopathy in the same manner as a permanent license up to the commencement of the next regular meeting of the state board of medical registration and examination following the date of issue when such permit shall expire: *Provided,* That neither the said board nor the secretary thereof shall have power to issue more than one temporary permit to any one person, nor to extend any such permit beyond the time herein limited.

Laws of 1908. Chapter 63.

An act amending chapter 254 *of the Laws of* 1901.

§1.—That section 6 of chapter 254 of the laws of 1901 be amended to read as follows:

§6.—Any person shall be regarded as practicing medicine and surgery within the meaning of this act who shall prescribe, or who shall recommend for a fee, for like use, any drug or medicine, or perform any surgical operation of whatsoever nature for the cure or relief of any wounds, fracture or bodily injury, infirmity or disease of another person, or who shall use the words or letters "Dr.," "Doctor," "M. D." or any other title in connection with his name, which in any way represents him as engaged in the practice of medicine or surgery, or any person attempting to treat the sick or others afflicted with bodily or mental infirmities, or any person representing or advertising himself by any means or through any medium whatsoever, or in any manner whatsoever, so as to indicate he is authorized to or does practice medicine or surgery in this state, or that he is authorized to or does treat the sick or others afflicted with bodily infirmities, but nothing in this act shall be construed as interfering with any religious beliefs in the treatment of diseases; provided, that

quarantine regulations relating to contagious diseases are not infringed upon. All persons who practice osteopathy shall be registered and licensed as doctors of osteopathy, as hereinbefore provided, but they shall not administer drugs or medicine of any kind nor perform operations in surgery. This act shall not apply to any commissioned medical officer of the United States army, navy or marine service in the discharge of his official duties; nor to any legally qualified dentist, when engaged in the legitimate practice of his profession; nor to any physician or surgeon who is called from another state or territory in consultation with a licensed physician of this state, or to treat a particular case in conjunction with a licensed practitioner of this state, and who does not otherwise practice in this state. Nor shall anything in this act apply to the administration of domestic medicines, nor to prohibit gratuitous services; provided, any person holding a diploma issued by an optical college, and who has studied the anatomy of the eye and contiguous parts, human physiology and natural physiology for at least six months under a competent teacher, and who shall pass the examination satisfactorily to the State Board of Medical Registration and examination, shall be eligible to register as an optician or doctor of optics, and shall be otherwise governed by this act so far as the same is applicable.

KENTUCKY

THE MEDICAL LAW OF KENTUCKY. As Amended in 1904.

ACT OF 1893.

SEC. 10.—Nothing in this law shall be so construed as to discriminate against any peculiar school or system of medicine, or to prohibit women from practicing midwifery, or to prohibit gratuitous services in case of emergency; nor shall this law apply to commissioned officers of the United States Army, Navy, or Marine Hospital Service, or to legally qualified physicians of another State, called to see a particular case or family, but who does not open an office or appoint any place in this State where he or she may meet patients or receive calls.

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Laws of Kentucky. Chapter 34, 1904.

SEC. 1.—Authority to practice medicine under this act shall be a certificate from the State Board of Health, registered in the county in which the holder resides, and said Board shall issue a certificate to any reputable physician who desires to practice medicine in this State, who has passed a satisfactory examination before it, in the branches of medicine as taught in reputable medical colleges; and said Board shall, upon application, admit to examination any person of good moral character, who may possess any of the following qualifications:

First.—A diploma from a reputable medical college, legally chartered under the laws of this State.

Second.—A diploma from a reputable and legally chartered medical college of some other State in this Union.

Third.—Satisfactory evidence from the person claiming the same that such person was reputably and honorably engaged in the practice of medicine in this State prior to February 23, 1884.

Applicants may present their credentials by mail or proxy and shall receive due notice of the place and date of the examination. Certificates shall be signed by the president and secretary, and attested by the seal of the board, and the fee for each examination, including the certificate, shall not exceed the sum of ten dollars. The members of the board shall be entitled to receive ten dollars per day and their necessary traveling expenses for each day devoted to such examinations, to be paid from the fees provided herein, and the board shall have authority to provide for such assistants as it may deem necessary and pay for the same from the fund arising from such fees.

SEC. 2.—Examinations shall be held at least semi-annually at Frankfort, Louisville, Lexington, or other centrally located places, and on such

dates as the board may deem will best suit the convenience of applicants. The questions for all examinations in the branches common to all schools or systems of practice shall be prepared by a committee of the board, to consist of five members, one of which shall he a homeopath, one an eclectic, and one an osteopath, and said committee shall conduct all examinations and grade the same, and when any applicant has made the average prescribed by law, and is so graded, the Board of Health shall admit such applicant to the practice of his or her profession in this State. All examinations shall be conducted in writing, and in such manner that the result shall be entirely fair and impartial, the applicants being known by numbers so that no member of the Board shall be able to identify the papers of any applicant until they have been graded and the case passed upon; and all questions and answers, with the grade attached, shall be preserved for one year. All applicants examined at any one time shall have the same questions asked them in anatomy, physiology, obstetrics, and the other branches common to all systems of practice, and shall be required to make an average grade of 70, with a minimum of 60 in any one branch; but all examinations, involving methods or principles of treatment shall be made and graded by that member of the Board who represents, or most nearly represents, the school or system of practice to which the applicant belongs, or the board may, in its discretion, omit the examination in such branches. No member of the board shall be a stockholder or member of the faculty or board of trustees of any medical college.

SEC. 3.—. . . . The State Board of Health may refuse to issue the certificate , provided for in this act for any of the following causes:

1. The presentation to the board of any license, certificate or diploma which was illegally or fraudulently obtained, or the practice of frauds or deception in passing examination.

2. The commission of a criminal abortion, or conviction of a felony involving moral turpitude.

3. Chronic or persistent inebriety or addiction to a drug habit to an extent which disqualifies the applicant to practice with safety to the people.

4. Or other grossly or unprofessional or dishonorable conduct of a character likely to deceive or defraud the public. The board may suspend or revoke a certificate, for any of the causes for which it may refuse to grant a license under the provisions of this act. . . .

SEC. 4.—Any person engaged in the practice of osteopathy in this State prior to February 1, 1904, who holds a diploma from a reputable osteopathic college, having a course of not less than four terms of five months each, legally chartered under the laws of any State in this Union, as determined by the osteopathic member of the board, and who makes application to the State Board of Health within ninety days after the passage of this act, accompanied by the fee hereinbefore provided, shall receive a certificate from the board without an examination, which, when

registered in the office of the county clerk of the county of his residence, as required of other certificates issued by the board, shall authorize the holder thereof to practice osteopathy in this Commonwealth, but it shall not permit him to administer drugs, nor to perform surgical operations with the knife. The words "practice of medicine" in this act, shall be held to include the practice of osteopathy. But no person shall be permitted to practice osteopathy in this Commonwealth without an osteopathic diploma and certificate as provided in this section.

SEC. 5.—Any other person applying for authority to treat the sick or injured, or in any way discharge the duties usually performed by physicians, whether by medical, surgical or mechanical means, shall apply to the State Board of Health, who shall examine them as to their competency in such manner as they may deem fair and best, but such examination shall always include anatomy, physiology and pathology, and the term "practice of medicine" as used in this act shall be construed to be the treatment of any human ailment or infirmity by any method; but this shall not include trained or other nurses, or persons selling proprietary or patent medicines, when not traveling as a troupe or troupes composed of two or more persons. But this does not apply to the practice of Christian Science.

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SEC. 7.—A board to be known as the State Board of Health is hereby established. It shall consist of eight members, all of whom shall be legally qualified registered practitioners under this act, seven of whom shall be appointed by the Governor by and with the advice and consent of the Senate, and the eighth member, who shall be the Secretary and executive officer, shall be elected by the board, and by virtue of his office of secretary shall be a member of the board. One member of the board shall be a homeopathic, one an eclectic and one an osteopathic physician, and the other appointed members shall be regular, or allopathic physicians, all to be appointed by the Governor from lists of three names for each vacancy, furnished respectively by the State Society or Association of such schools or systems of practice as are entitled to the member, and the successors of such members shall be appointed in the same manner. If the board shall elect one of its members secretary, as it may do, the Governor shall appoint another member to complete the full number of the board. The president and secretary shall have authority to administer oaths for the purposes of this act, and the members of the board shall, before entering upon the discharge of their duties, take the oath prescribed by the Constitution for State Officers.

SEC. 8.—This act shall take effect and be in force in accordance with the provisions of the Constitution, but it is expressly provided that all certificates issued by the board under provisions of the law to which this is an amendment, are hereby confirmed and continued in force, and all students who are matriculated in any medical or osteopathic college

in this Commonwealth on or before Feb. 1, 1904, and shall have graduated prior to September 1, 1907, and make application to the board prior to January 1, 1908, shall receive certificates without examination. All acts and parts of acts in conflict with the provisions of this act are hereby repealed.

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LOUISIANA

THE MEDICAL LAW OF LOUISIANA FROM THE REVISED LAWS, 1904.

An Act to regulate the practice of medicine. . . . .

SEC. 1.—Be it enacted by the General Assembly of the State of Louisiana, That from and after the promulgation of this act, no person excepting those already engaged under existing laws in the practice of medicine, surgery, midwifery and dentists, shall practice medicine in any of its departments within the State of Louisiana, unless such person shall possess all the qualifications required by this act.

SEC. 2.—Be it further enacted, etc., That after the promulgation of this act, any person before entering upon the practice of medicine in any of its branches, dentists excepted, shall present to the board of medical examiners, as hereinafter constituted, a diploma from a medical college and in good standing, said standing to be determined by the board, and shall pass a satisfactory examination before the board upon the following branches, to-wit: Anatomy, physiology, chemistry, principles of medicine, obstetrics, physical diagnosis, surgery, materia medica and hygiene. The person shall also satisfy the board that he or she is twenty-one years of age, of good moral character, and possesses at least a fair primary education. If said diploma and examination are satisfactory to the board they shall issue to such person a certificate in accordance with the facts.

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SEC. 7.—That the board of examiners shall hold two regular meetings each year, one in the city of New Orleans, and one in the city of Monroe, La., but the president of the board may call meetings elsewhere in the State whenever the board may deem it necessary or expedient. The call to be issued by the secretary and signed by the president.

SEC. 8.—Be it further enacted, etc., That to prevent delay and inconvenience, one member of a board of medical examiners may grant a permit after a satisfactory examination to any applicant, and shall report thereon to the boards at the next regular meeting; such temporary permit shall not continue in force longer than until the next regular meeting of the boards, but such temporary permit shall in no case be granted within six months after the applicant has been refused a permit by the boards.

SEC. 9.—Be it further enacted, etc., That the certificates issued in accordance with section 2 of this act shall be recorded in the office of the clerk of the district court of the parish in which he or she resides

who shall make this recordation in a book to be kept for that purpose only, and shall also certify to such recordation by an indorsement of the original certificate, which the holder thereof shall transmit or deliver to the State board of health; and the clerk recording the same shall be entitled to a fee of one dollar. Such certificate transmitted or delivered to the State board of health shall entitle the holder to be placed on the list of registered physicians and surgeons, the publication of which is hereinafter provided for. Said board of health shall preserve such certificates, and a copy thereof, signed by its secretary, shall be received as evidence in the courts of this State, and for such copy a fee of fifty cents shall be paid. Until such recordation is made, the holder of such certificate shall not exercise any of the rights or privileges therein conferred to practice medicine.

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SEC. 11.—. . . . The boards are empowered to demand a fee of one ($1) dollar for the issuing of each certificate. The fee for examination shall be ten ($10) dollars. If the applicant fails to pass a satisfactory examination, and no certificate is issued to him or her, five ($5) dollars, to be paid into the treasury of the boards, only of his or her fee is to be retained. The fee for certificate of temporary permit shall be five ($5) dollars, to be paid into the treasury of the boards, said fee to be accredited to the applicant when he applies to the boards for a permanent permit.

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SEC. 13.—Be it further enacted, etc., That any person shall be regarded as practicing medicine, in any of its departments, within the meaning of this act, who shall append the letters M. D. or M. B. to his or her name, or repeatedly prescribe or direct, for the use of any person or persons, any drug or medicine or other agency for the treatment, cure or relief of any bodily injury, infirmity or disease. This act shall not apply to farmers and planters when exclusively practicing, without compensation, on their employés and tenants.

SEC. 14.—Be it further enacted, etc., That if any person shall practice medicine in any of its departments in this State, without first having obtained the certificate herein provided for, or contrary to the provisions of this act the Board of Medical Examiners created by this Act may through their respective presidents cause to issue in any competent court a writ of injunction forbidding and enjoining said person from further practicing medicine in any of its departments of this State, until such person shall have first obtained the certificate herein provided for and under the provisions of this act.

That said injunction shall not be subject to being released upon bond. That in the same suit in which said injunction may be applied for, the said boards through their respective presidents aforesaid, may sue for and demand of the defendant a penalty not to exceed one hundred

dollars; and in addition thereto attorney's fees not to exceed fifty dollars, besides the costs of court; judgment for which penalty, attorney's fees, and costs may be rendered in the same judgment in which the injunction may be made absolute. That the trial of said proceeding shall be summary, and be tried by the judge without the intervention of a jury (as amended by Act. 13, 1896).

SEC. 15.—Be it further enacted, etc., That the said boards shall have power to revoke any permit or certificate issued by them whenever it shall appear that the physician thus licensed has been convicted of immoral conduct before a competent court.

SEC. 16.—Be it further enacted, etc., That any practitioner of medicine, in any of its departments, failing to comply with the requirements of this act, shall not be exempt from jury or military duty, nor be permitted to collect any fees or charges for services rendered, nor be allowed to testify as a medical or surgical expert in any court in this State, nor execute any certificates as a physician or surgeon, nor to hold any medical office, nor to be recognized by the State or parish or municipal corporation as a physician or surgeon; nor shall he be entitled to enjoy any of the privileges, rights or exemptions granted to physicians or surgeons by the laws of this State.

SEC. 17.—Be it further enacted, etc., That this act shall not apply to any commissioned surgeon of the United States army, navy or marine hospital service; to physicians or surgeons from other States or territories in actual consultation with a registered physician of this State, nor to any physician actually practicing in this State before the passage of this act and in accordance with then existing laws.

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SEC. 20.—Be it further enacted, etc., That all laws or parts of laws in conflict with this act be and the same are hereby repealed.

MAINE

MEDICAL PRACTICE ACT. CHAPTER 170, ACTS OF 1895. STATE OF MAINE. IN THE YEAR OF OUR LORD ONE THOUSAND EIGHT HUNDRED AND NINETY-FIVE.

An Act to Regulate the Practice of Medicine and Surgery.

Be it enacted by the Senate and House of Representatives in Legislature assembled, as follows:

SECTION 1.—The governor with the advice and consent of the council, shall appoint six persons, ... who shall constitute a board of registration of medicine.

. . . . . .

SECTION 4.—Any person not entitled to registration as aforesaid shall, upon the payment of a fee of ten dollars, be entitled to examination and if found qualified by a majority of the members of the board present shall be registered as a physician or surgeon, and shall receive a certificate thereof as provided in section three. Any person refused registration may be re-examined at any regular meeting of said board, within two years of the time of such refusal, without additional fee, and thereafter may be examined as often as he may desire upon the payment of the fee of ten dollars for each examination. . . . .

. . . . . .

SECTION 8. (As amended March 22, 1901.)—On and after the passage of this act, the board shall examine all applicants for registration as licensed physicians or surgeons. Each applicant shall, at least seven days before the date of his examination, present to the secretary of the board an application under oath or affirmation, giving satisfactory proof of being twenty-one years of age, of having good moral character and of being a graduate of some reputable medical school or college having power to confer degrees in medicine, and in good standing, and maintaining a standard of preliminary education and of medical instruction approved by the board. He shall also present such other facts as the board in its blank application may require, and must pay the fees herein provided. Examinations shall be in whole or in part in writing and shall be of an elementary and practical character. They shall embrace the general subjects of anatomy, physiology, pathology, materia medica and therapeutics, surgery, the principles and practice of medicine, and obstetrics, or such branches thereof as the board may deem necessary for the applicant to possess. The board is also hereby authorized to make such rules and regulations as may be

necessary for reciprocity of licensure with the boards of other states which maintain a standard of education at least equal to their own; but no such rules shall become operative until they have been approved by a justice of the supreme judicial court.

SECTION 9.—On and after the first day of January, eighteen hundred and ninety-six, it shall be illegal for any person not duly registered by this board to practice medicine or surgery, or any branch thereof for gain or hire within this state. Whoever not being registered as aforesaid shall so practice or shall advertise or hold himself out to the public as a physician or surgeon in this state who appends to his name the letters "M. D." or who uses the title of a doctor or physician, meaning thereby a doctor of medicine, shall be punished by a fine of not less than one hundred nor more than five hundred dollars for each offense, or by imprisonment in jail for three months, or both.

SECTION 10. (As amended March 22, 1901.)—This act shall not apply to commissioned officers of the United States army, navy, or marine hospital service, or to a physician or surgeon who is called from another state to treat a particular case and who does not otherwise practice in this state, nor to prohibit gratuitous service or the rendering of assistance in emergency cases, nor to mid-wives who lay no claim to the title of physician or doctor.

SECTION 11.—Neither shall this act apply to clairvoyants or to persons practicing hypnotism, magnetic healing, mind cure, massage, Christian science, so-called, or any other method of healing if no poisonous or dangerous drugs are employed nor surgical operations performed; provided, such persons do not violate any of the provisions of section nine of this act in relation to the use of "M. D.," or the title of doctor or physician.

SECTION 12.—For the purposes of the appointment of said board and of registration of persons by it hereunder, this act shall take effect upon its passage and shall take full effect on the first day of January, in the year eighteen hundred and ninety-six.

March 27th, 1895.

SECRETARY'S OFFICE.[1]

SACO, MAINE, November 1, 1905.

Reciprocity has been established between the Maine Board of Registration of Medicine and the licensing boards of the following states, viz.:—Vermont, New Jersey, South Carolina, Georgia, Maryland, Texas, Ohio, Indiana, Illinois, Wisconsin, Michigan, Iowa, Missouri, South Dakota, Minnesota, Wyoming and District of Columbia.

Secretary.

[1] From a letter to the author.

MARYLAND

EXTRACTS FROM THE CODE OF MARYLAND, 1904. PRACTITIONERS OF MEDICINE.

78.—All persons not now practicing medicine and surgery, or who shall hereafter begin to practice medicine and surgery, in any of their departments, except dentistry, in the State of Maryland, shall possess the qualification required by this sub-title.

79.—From and after the first Tuesday in June, eighteen hundred and ninety-two, there shall be and continue to be two separate Boards of Medical Examiners for the State of Maryland, one representing the Medical and Chirurgical Faculty of the State of Maryland, and one representing the Maryland State Homeopathic Medical Society of the State of Maryland. . . . .

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81.—Each board of medical examiners shall meet on the first Tuesday in June in each year for the purpose of re-organization. . . . . For the purpose of examining applicants for a license, each of said boards of medical examiners shall hold one or more stated or special meetings in each year, due notice of which shall be made public at such time and places as may be determined by the members thereof, respectively. At said stated or special meeting a majority of the members of the board shall constitute a quorum thereof. . . . .

82.—At the first meeting of an examining board, or at a stated or special meeting held subsequently, suitable provisions shall be made by each of the examining boards to prepare a schedule of written examination upon anatomy, physiology, chemistry, surgery, practice of medicine, materia medica, therapeutics, obstetrics, and pathology, and the same standard of excellence shall be required for all candidates. In the department of therapeutics and practice the questions shall be in harmony with the tenets of the school selected by the candidate; the standard of acquirements therein to be established by each board for itself. Whenever the members of any board are necessarily absent from meetings held for the examination for applicants for license, suitable temporary provision shall be made for thorough examination in each and all of the aforesaid subjects by the members present. The examination shall be fundamental in character and such as can be answered in common by all schools of practice. The votes of all the examiners present shall be "yes" or "no", written with their signature upon the backs of the examination papers of each candidate for the respective branches.

83.—All persons, except physicians who were practicing medicine in this State prior to the first day of January, 1898, who are now practicing medicine or surgery and can prove by affidavit that within one year of said date said physician had treated in his professional capacity at least twelve persons, who shall commence the practice of medicine or surgery in any of their branches after the 11th day of April, 1902, shall make a written application for license to the president of either board of medical examiners which said applicant may elect, accompanied by satisfactory proof that the applicant is more than twenty-one years of age, is of good moral character, has obtained a competent common school education, and has either received a diploma conferring the degree of doctor of medicine from some legally incorporated medical college in the United States or a dipoma or license conferring the full rights to practice all the branches of medicine and surgery in some foreign country; said diploma, if from a college in the United States, must have been conferred by a legally incorporated college requiring a four years' standard of education, as defined by the American Medical College Association or the intercollegiate committee of the American institute of homeopathy, respectively; provided, that this requirement shall not apply to any physician who shall, prior to the eleventh day of April, 1902, have practiced outside of this State for at least three years, and who shall have been duly registered or licensed in the place where he has so practiced, provided further, that two courses of medical lectures, both of which shall be either begun or completed within the same calendar year, shall not satisfy the above requirements: provided also, that in the case of students who on April 11, 1902, shall be in their second year in a medical college, a three years' course of study, or attendance on three courses of lectures delivered in different years, shall satisfy said requirements. Proof of the qualifications of applicants as above shall, if required, be made by affidavits at the time of the making of said application and payment of fee as provided. The president of the board to whom such application shall have been made, if satisfied with the same, shall direct the secretary-treasurer thereof to issue to said applicant an order for examination, and when said applicant shall have passed an examination as to proficiency satisfactory to said board the president thereof shall grant to such applicant a license to practice medicine and surgery in the State of Maryland. If the president of either board of medical examiners shall have refused any application, either for want of the qualifications necessary to entitle such applicant to an examination, as hereinbefore provided, or for want of proficiency of such applicant upon being subjected to an examination, then the president of neither of said boards shall entertain or pass upon a subsequent application from said applicant until after the expiration of six months from the rejection of said previous application. The respective boards are authorized to license without examination applicants who present proper certificates or proficiency and professional standing at the time of application issued by boards of medical examiners of the District of

Columbia and of other States, the requirements of which are as high a standard as those governing the boards of medical examiners of this State, provided such boards of said States or District grant the same privileges to licentiates of the examining boards of Maryland; such applicants, however, being still required to furnish the same proof of qualifications required of other applicants by this section. Medical students, at the end of their second year of study, who have, as verified by the certificate of the dean of the college which they have attended, completed the studies of anatomy, physiology, medical chemistry and materia media in said college, shall on application be examined in such studies by the State licensing board, the result of said examination to be considered as part of the final examination, the full regular fee to be paid at this time, no part thereof to be returned, but placed to their credit for the remainder of the examination yet to be taken. Medical students who have, as verified by the certificate of the dean of the college which they have attended, completed a full four years' course of studies and lectures, but who have not yet received their diplomas, shall upon application be examined in all the branches enumerated in section 82 by State licensing board, the final certificate and license of the said board being withheld until the diploma of the proper medical college, with the candidate's name inscribed, be produced to the secretary of the board. Diplomas presented by graduates of foreign colleges shall be accepted if a course of four years' study has been required by said foreign college before issuing such diploma.

84.—Any physician who may change his residence from the District of Columbia to the State of Maryland, or who while living in the District of Columbia shall desire to practice medicine or surgery in the state of Maryland shall, upon application to the examining board of the state of Maryland, be entitled to a license without fee and without examination; provided, that the application be properly endorsed at the time it is presented by the examining board of the District of Columbia, certifying to the proficiency and professional standing of the applicant; and provided further, that the examining board of the District of Columbia shall, under the laws thereof, grant like and equal privileges to licensed physicians of this State who may remove to said District of Columbia, or while continuing to reside in this State may desire also to practice in said district.

85.—All examinations shall be conducted in such manner that the name, school of graduation and preparatory training of said applicant shall not be made known to the board of examiners until his examination papers have been graded. An applicant receiving a majority of the votes of the board before whom the applicant appears shall be considered to have passed a satisfactory examination and entitled to the license of said board.

86.—A fee of twenty dollars shall be paid to the secretary-treasurer of the board, before whom the applicant appears, before such examination is had, which payment shall entitle said applicant to a second ex-

amination, in case of failure, at the expiration of six months and within twelve months thereafter; said fee to be applied by said board toward paying the expenses of said board.

87.—The board shall refuse to grant a license to any applicant who may be radically deficient in his examination in any essential branch; provided, that in any case of failure at any such examination, the candidate shall not be permitted to take another examination before either board until after the expiration of six months from the date of his rejection; provided, however, that any applicant who has heretofore, during the previous year before the eleventh day of April, 1902, or who shall hereafter so fail, shall be credited as having passed in such branches as he has or shall have bee found proficient in, and he shall not be again examined in said subjects.

88.—Every license to practice medicine and surgery, issued pursuant to the provisions of this sub-title, shall be subscribed by the president and secretary of the board before whom the applicant has passed; it shall also have affixed to it by the person authorized to affix the same, the seal of said Medical and Chirurgical Faculty of Maryland, or of the Maryland State Homeopathic Medical Society, as the license may require, every such license to be in the following form, and to the following effect:

To All Whom it May Concern, Greeting:

Be it known, that ....., on the ..... day of ..... A. D., having offered us satisfactory proof that ..... was more than twenty-one years of age, and had received a proper preliminary education; we therefore give a written order for the examination of said ..... before one of the Board of Medical Examiners of the State of Maryland; that the said ..... was fully examined before our said Board and found proficient and qualified to practice medicine and surgery, we, therefore, have granted to said.....this, our license to practice medicine and surgery in the State of Maryland as a physician and surgeon, and have caused the names of the president and secretary of our board to be subscribed and the seal of our society to be affixed thereto.

Witness our hands and the seal of said society, this day of ....A.D.....president; .....secretary.

89.—Any person receiving a license from either of said boards shall file the same at once with the clerk of the circuit court of the county in which he or she may reside, or with the clerk of the circuit court of Baltimore city, if said person shall reside therein, and it shall be the duty of said clerk to register the name of said person and of the president of the board signing said license in a book kept for the purpose, as a part of the records of his office; and the number of the book and the page therein containing said recorded copy shall be noted by said clerk upon the face of said license. In case said person should, after the recording of such license, permanently remove his or her residence to some other

part of the State, or to Baltimore city, he or she shall thereupon at once file said license, or certified copy thereof, for record as aforesaid, with the clerk of the circuit court of the county or city to which he or she shall have so removed; said records shall be opened to public inspection under proper restrictions as to their safe keeping, and in all legal proceedings shall have the same weight as evidence that is given to the records of conveyances of lands. Fees for such registration shall be fifty cents, to be paid by the person whose license is registered. The clerk of the superior court of Baltimore city is authorized and directed to turn over to the clerk of the circuit court of Baltimore city the register or registers of licensed physicians which he has been required to keep under and by virtue of the said chapter 612 of the acts of 1902.

90.—Any person to whom the provisions of this sub-title applies, practicing or attempting to practice medicine or surgery in this State, without first having obtained the license of one of said boards of medical examiners, shall be guilty of a misdemeanor, and shall pay a fine of not less than fifty dollars, nor more than two hundred dollars for each offence, or in default of payment shall be confined in the city or county jail until the fines and costs are paid, and shall be debarred from recovering compensation for services rendered as such physician or surgeon.

. . . . . .

92.—Said board shall upon request issue certificates of professional standing to physicians moving out of the State.

93.—From and after the first day of July, 1894, no person shall practice medicine or surgery in the State of Maryland, unless he or she shall be duly registered as a physician or surgeon, in accordance with the provisions of this sub-title applies.

94.—Every person who was practicing medicine in the State of Maryland, on or before the first day of June, 1892, shall be entitled to be registered as a physician or surgeon or both, upon making application to the president of either Board of State Medical Examiners, which application shall be made in writing, and verified by oath of said applicant, taken before any officer entitled to administer oaths under the law of this State, and shall state that the applicant was a duly qualified, lawful practitioner of medicine in said State, on or before said first day of June, 1892. And upon receiving said application, and being satisfied of the truth of the statement therein contained, said president of such board shall issue or indorse his permit for such applicant to be registered, upon a copy of such application, which permit shall also be countersigned by the secretary of said board; and any president of such board, to whom such application is addressed, may in his discretion make inquiry, and examine witnesses under oath, or receive evidence as to the truth of the statements contained in such application, for a permit to be registered; and if the president of either of such boards of medical examiners, shall act upon application, and shall refuse the same, then no president of either of said boards shall

entertain or act upon any application of such applicant for such permit. And upon the presentation of a permit to be registered, signed by the president, and countersigned by the secretary of either of said boards of medical examiners, to the clerk of the county where such applicant may reside, or to the Clerk of the Circuit Court of Baltimore City, if the said applicant shall reside in Baltimore City, it shall be the duty of said clerk to register such application and permit, and the name of such applicant as physician or surgeon or both, in a book to be kept for such purpose, and a certified copy of such entry of registration under the seal of the court, shall be legal evidence of such registration in all the courts of the State; provided, however, that the provisions of this act shall not apply to those practicing medicine in the State of Maryland prior to June, 1892, and who registered as practitioners of medicine prior to July, 1894.

95.—All persons who have commenced to practice medicine or surgery in the State of Maryland since the first day of June, 1892, or who shall hereafter commence to practice medicine or surgery in this State, shall not be entitled to be registered in the registery of physicians and surgeons, as required by law, except upon filing with the clerk of the circuit court of the country or city in which he or she may reside, a license from one of the duly constituted boards of medical examiners of this State, in accordance with the terms of section 88 and 89, except that physicians and surgeons who have come into this State since said first day of June, 1892, or who shall hereafter come into this State to follow the practice of medicine and surgery, may receive a license which shall entitle them to be registered as physicians and surgeons, in accordance with the law, upon application to one of the duly constituted boards of medical examiners, in accordance with the provisions of section 96 of this sub-title.

96.—Physicians and surgeons of good moral and professional standing who shall hereafter come into this State with intent to follow the practice of "medicine and surgery" within this State, being graduates of a medical college or university of good standing, or having a certificate or license from a board of medical examiners of any State where the requirements for practice are equal to those required by the board named in this article, may make application to the president of either board of medical examiners in this State, which application shall be made under oath, and shall state how long said applicant has been engaged in the practice of medicine and surgery, and from what medical college, university or other institution of learning he or she has graduated. And thereupon, the board of medical examiners shall have the authority and discretion to require applicants to undergo an examination, in accordance with provisions of section 81 or 87, inclusive, or may require said applicant to submit to a special examination, the terms and methods of which shall be prescribed by the board of medical examiners, and upon paying the fee for examination, as set out in section 86. After the examination and determination of said

board, thereupon, that said applicant is qualified to practice medicine and surgery, and that he is entitled to a license, a license shall be issued to him to the same effect as the form of license set out in section 88, which license shall be filed and recorded as provided by section 89; and it shall then be the duty of the clerk of the court to register the name of the person so licensed as physician or surgeon, or both, in accordance with the provisions of this sub-title.

97.—All persons whose licenses have been heretofore filed and recorded in accordance with section 89 of this sub-title shall be held to be duly registered physicians and surgeons within the provisions of section 94 of this sub-title, and all persons who shall hereafter receive and file licenses to be recorded in accordance with said section 89, shall be registered as physicians and surgeons under said section, and the fee to be paid for such registration and for the registration of the application to the clerk, or the license therewith, as the case may require, shall be one dollar.

98.—If any person shall unlawfully obtain and procure himself to be registered as physician or surgeon, either by false and untrue statement contained in his application to the clerk of this court, as required by this sub-title, or by presenting to said clerk a false or untrue license, or one fraudulently obtained by false and fraudulent statements made to one of said boards of medical examiners, he or she shall be deemed guilty of a misdemeanor, and shall be fined not less than fifty dollars, or more than five hundred dollars, and shall forfeit all rights and immunities obtained or conferred upon him by virtue of such registration as physician and surgeon.

99.—Any person who after the first day of July, 1894, shall practice or attempt to practice medicine or surgery in this State without being registered in accordance with the provisions of this sub-title, shall be guilty of a misdemeanor, and shall be fined not less than ten dollars nor more than two hundred dollars for each offense.

100.—Any citizen of Maryland having information which causes him to believe that any person has been heretofore wrongfully registered as physician or surgeon, or both, upon his application to the clerk of any county may apply, by petition, to the circuit court of the county wherein such registration, or to the city court of Baltimore city, if such registration was in Baltimore city, which petition shall be under oath, and shall state that the petitioner is informed and believes that the person named therein has been heretofore improperly and wrongfully registered as physician or surgeon, or both, upon his own application and affidavit upon the register of physicians or book kept for such purpose in any court of this State, for the reason (as said petitioner is empowered) that such person was not lawfully practicing medicine in the State of Maryland, as a duly qualified practitioner of medicine in said State, entitled to be registered as a physician or surgeon upon his own application to the clerk of said court; and that said petitioner prays that the name of such person shall be struck from the

registry of physicians aforesaid. Upon the filing of such petition the court or one of the judges thereof shall pass an order requiring the person therein alleged to be wrongfully or improperly registered to answer the same, under oath, on or before a date to be named within thirty days from the date of such order, and to show cause, if any there be, why the prayer of such petitioner should not be granted, which order shall be served upon said last-named person; and if said petition shall not be answered within the time named, as aforesaid, or if the answer thereto shall be adjudged insufficient by the court, the court shall pass an order directing that the name of such person alleged to be wrongfully or improperly registered shall be stricken from the registry of physicians and surgeons where the same shall have been registered; but if said petition shall be answered by the defendant, being the person against whom it is exhibited by an answer under oath, fairly and fully denying the allegations of said petition, the issues thus raised shall be heard and determined by the court, and either party may be entitled to a jury trial before a jury of the regular panel empaneled to try common law cases in said court; and the defendant shall be competent and compellable to testify at such hearing, and upon such hearing the court shall render judgment with costs against the unsuccessful party. And if it shall determine that said defendant was not practicing medicine in the State of Maryland on or before the date of June 1st, 1892, not being a lawful practitioner of medicine in said State, on or before said date, it shall pass an order directing the name of said defendant to be stricken from the registry of physicians and surgeons or both, which order shall be certified by the clerk of the court wherein said defendant was registered, and he shall thereupon strike his name from the said registry. But the decision upon such petition shall have no force and effect in any criminal prosecution under this sub-title.

101.—Any person shall be regarded as practicing medicine within the meaning of this sub-title who shall operate on or prescribe for any ailment of another, or who shall append to his or her name the letters M. D., or prefix the word doctor, or the abbreviation thereof, Dr., or to his or her name, with the intent thereby to imply that he or she is a practitioner of medicine or surgery; but nothing herein contained shall be construed to apply to gratuitous services, nor to any resident or assistant resident physicians or students at hospitals in the discharge of their hospital or dispensary duties, or in the office of physicians or to any physician or surgeon from another state, territory or district in which he resides when in actual consultation with a legal practitioner of this State; or to commissioned surgeons of the United States army or navy or marine hospital service, or to chiropodists, or to midwives, or to masseurs or other manual manipulators who use no other means; nor shall the provisions of this sub-title apply to physicians or surgeons residing on the borders of a neighboring State, and duly authorized under the laws thereof to practice medicine or surgery therein, whose practice extends into the limits of this State; provided, that such practitioners shall not open an office

or appoint places to meet their patients or receive calls within the limits of this State without complying with the provisions of this sub-title; provided, that the same privileges be accorded to licensed physicians of this State; provided, further, that nothing in this sub-title shall annul any of the provisions of article 32, title "Dentistry," nor shall apply to any registered graduate of dental surgery now practicing in the said State of Maryland, with the sign titles; dentist, surgeon dentist, dental surgeon or stomatologist.

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105.—Any person practicing or attempting to practice medicine under the name of any other person, whether that person be a resident of this State or not, or whether he or she be deceased or not, or any person acting under the name of and as agent of any other person, in the capacity of a practitioner of medicine or surgery, shall be guilty of a misdemeanor, and upon conviction by any court having criminal jurisdiction shall be punished by imprisonment in the city or county jail for not less than thiry days nor more than one year, or by a fine of not less than twenty dollars nor more than five hundred dollars, or both, in the discretion of the court, for each offense.

106.—Either board of medical examiners of this State may, by a vote of five members, revoke any license which it has issued, and may cause the name of any physician licensed by said board to be removed from the register of the licentiates of the city or county where it may be recorded for any of the following causes, to wit: That use of fraud or deception in passing the examination provided in this sub-title, habitual drunkenness, criminal abortion, conviction of crime involving moral turpitude or unprofessional or dishonorable conduct. Before proceeding to revoke any such license, the person against whom complaint is made shall be furnished with a copy of the complaint and charges made against him, and shall be given an opportunity for a hearing before the board, in person or by attorney, and at such hearing testimony may be offered for and against the accused.

MASSACHUSETTS

EXTRACTS FROM THE LAW RELATING TO THE REGISTRATION OF PHYSICIANS IN MASSACHUSETTS. (Revised Laws, Chapter 76, Sections 1–9.)

SECTION 1.—There shall be a board of registration in medicine consisting of seven persons, residents of this commonwealth, who shall be graduates of a legally chartered medical college or university having the power to confer degrees in medicine, and who shall have been for ten years actively employed in the practice of their profession. No member of said board shall belong to the faculty of any medical college or university, and no more than three members thereof shall at any one time be members of any one chartered state medical society. One member thereof shall annually in June be appointed by the governor with the advice and consent of the council for a term of seven years from the first day of July following.

SECTION 2.—Said board shall hold regular meetings on the second Tuesday of March, July and November in each year, and additional meetings at such times and places as it may determine. At the regular meeting in July, it shall organize by the choice of a chairman and secretary who shall hold their offices for the term of one year. The secretary shall give a bond to the treasurer and receiver general in the penal sum of five thousand dollars, with sufficient sureties to be approved by the governor and council, for the faithful performance of his official duties.

SECTION 3.—Applications for registration shall be made upon blanks to be furnished by the board, and shall be signed and sworn to by the applicants. Each applicant for registration shall furnish satisfactory proof that he is twenty-one years of age or over and of good moral character and, upon payment of a fee of twenty dollars shall be examined by said board. If he is found by four or more members thereof to be twenty-one years of age or over, of good moral character and qualified, he shall be registered as a qualified physician and shall receive a certificate thereof signed by the chairman and secretary. An applicant who fails to pass an examination satisfactory to the board, and is therefore refused registration, shall be entitled within one year after such refusal to a re-examination at a meeting of the board called for the examination of applicants, without the payment of an additional fee; but two such re-examinations shall exhaust his privilege under his original application. . . . .

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SECTION 5.—The board shall keep a record of the names of all persons registered hereunder, and of all money received and disbursed by it, and a duplicate thereof shall be open to inspection in the office of the secretary of the commonwealth. Said board shall annually, on or before the first day of January, make a report to the governor of the condition of medicine and surgery in this commonwealth, of all its official acts during the preceding year and of its receipts and disbursements.

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SECTION 7.—Examinations shall be wholly or in part in writing in the English language, and shall be of a scientific and practical character. They shall include the subjects of anatomy, surgery, physiology, pathology, obstetrics, gynecology, practice of medicine and hygiene, and shall be sufficiently thorough to test the applicant's fitness to practice medicine.

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SECTION 9.—The provisions of the eight preceding sections shall not be held to discriminate against any particular school or system of medicine, to prohibit medical or surgical service in case of emergency, or to prohibit the domestic administration of family remedies. They shall not apply to a commissioned medical officer of the United States army, navy, or marine hospital service in the performance of his official duty; to a physician or surgeon from another state who is a legal practitioner in the state in which he resides, when in actual consultation with a legal practitioner of this commonwealth; to a physician or surgeon residing in another state and legally qualified to practice therein, whose general practice extends into the border towns of this commonwealth, if such physician does not open an office or designate a place in such towns where he may meet patients or receive calls; to a physician authorized to practice medicine in another state, when he is called as the family physician to attend a person temporarily abiding in this common-wealth; nor to registered pharmacists in prescribing gratuitously, osteopathists, pharmacists, clairvoyants, or persons practicing hypnotism magnetic healing, mind cure, massage, Christian science or cosmopathic method of healing if they do not violate any of the provisions of section eight.

MICHIGAN

THE LAWS OF MICHIGAN ARE EMBRACED IN THE NOTTINGHAM MEDICAL ACT. ACT NO. 191, LAWS OF 1903. Amending Act 237, Laws of 1899. In force Sept. 17, 1903. Also Amendments of 1905 and 1907.

SECTION 1.—The Governor shall appoint, by and with the advice and consent of the Senate, ten resident electors of the State, who shall constitute a board of Registration in Medicine. Not more than five of the persons so appointed shall be from the school of medicine known as regular; not more than two of the persons so appointed shall be from the school of medicine known as homeopathic; not more than two of the persons so appointed shall be from the school known as eclectic; and not more than one of the persons so appointed shall be from the school of medicine known as physiomedical, and the Governor may select such appointees from the latest lists filed in the office of the Secretary of State at Lansing by each of the four legally incorporated State medical societies of the schools of medicine as herein mentioned aforesaid, such lists to be certified to under oath of the president and secretary of each society respectively, and such lists to contain at least treble the number of names as each society has representatives on the board. . . . .

SECTION 2. (1899).— . . . . The said board shall have two regular meetings in each year, beginning with the year 1899, one on the second Tuesday of October, 1899, and one on the second Tuesday of June, 1900, and so on, and such additional meetings at such times and places as it may determine.

SECTION 3. (1907).—On and after the date of the passage of this act, all men and women who wish to begin the practice of medicine and surgery in any of its branches in this State, shall make application to the State Board of Registration in Medicine, to be registered and for a certificate of registration. This registration and certificate shall be granted to such applicants as shall give satisfactory proofs of being twenty-one years of age and of good moral character, but only upon compliance with at least one of the following conditions contained in subdivisions one, two and three of this section:

First, that applicant shall be registered and given a certificate of registration if he shall satisfactorily pass an examination before the board upon the following subjects: Anatomy, physiology, chemistry, pathology, materia medica and therapeutics, toxicology, histology, practice of medicine, surgery, obstetrics, gynecology, mental and nervous diseases, diseases of the eye, ear, nose and throat, bacteriology,

hygiene, public health laws of Michigan and medical jurisprudence; said examination to be conducted as follows:

(a) The applicant shall pay a fee of twenty-five dollars prior to examination: *Provided,* That if the examination is divided the applicant shall pay ten dollars for the first examination and fifteen dollars for the final examination;

(b) The examination shall be in writing, oral, or both;

(c) The questions on all subjects, except in materia medica and therapeutics and practice of medicine, shall be such as may be answered alike by all schools of medicine;

(d) The applicant shall, if possible, be examined in materia medica and therapeutics and practice of medicine by those members of the board or by a qualified examiner appointed by the board, belonging to the same school as the applicant, and no applicant shall be rejected because of his adherence to any particular system of practice;

(e) An average percentage of at least seventy-five percent of correct answers on all of the subjects listed under this section, and of not less than fifty percent on each subject, shall be required of every applicant: *Provided,* That in case of a qualified applicant who has been in reputable practice at least five years, at the discretion of the board, this requirement of minimum percentage may be modified by the board to meet the necessities of the case. No additional fee shall be charged by this board for the registration of those who successfully pass such examination: *Provided, however,* That such applicant for examination shall have a diploma from a legally incorporated, regularly established and reputable college of medicine within the States, territories, districts and provinces of the United States, or within every foreign nation, provided such foreign nation accord a like privilege to graduates of approved medical colleges of this State, having at least a four years' course of seven months in each calendar year, as shall be approved and designated by the Board of Registration in medicine: *Also provided,* That such applicant shall have, previous to the beginning of his course in medicine, a diploma from a recognized and reputable high school, academy, college or university, having a classical course, or shall pass an examination equivalent at least to the minimum standard of preliminary education adopted and published by the board before examiners appointed by and in accordance with the regulations of aforesaid board, and at such time and place as the board may designate: *Provided,* A student entering a college in Michigan, having a preliminary examination of a standard approved by the Board of Registration of Medicine shall not be required to take this examination: *Provided,* That this requirement of preliminary education shall not apply to those students who, on the date of the passage of this act, were regularly registered as students of legally organized and reputable medical colleges approved of by said board: and *Provided also,* That the requirement of medical education shall not apply to those graduates of legally organized and reputable medical colleges approved of by said

board who had graduated from such colleges, previous to the date of the passage of this act; and students complying with the other provisions of this section who, on January first of the present year, were regularly registered as students of legally organized and reputable medical colleges of this State, approved of by said board, may obtain a certificate of registration as graduates of such colleges and without examination by the board upon payment of a fee of ten dollars. The Board of Registration in Medicine shall, from time to time, adopt and publish a minimum standard of medical education, and no medical college shall be approved and designated by said board under this sub-division one, of section three, unless, in the judgment of the board, it conforms with such standard: *Provided*, That any raising of the standard of medical education, including preliminary education, by the board under this provision shall not go into effect until at least one year after its adoption and publication by the board: And *provided further*, That the standard of preliminary education under the provisions of this act shall not exceed the standard fixed for admission to the literary department of the University of Michigan;

Second.—The applicant shall be registered and given a certificate of registration if he shall present a certified copy or certificate of registration or license which has been issued to said applicant in any foreign nation where the requirements of registration shall be deemed by said Board of Registration in Medicine to be equivalent to those of this act: *Provided*, Such country shall accord a like privilege to holders of certificates from this board. The fee for registration from applicants of this class shall be fifty dollars.

Third.—The applicant shall be registered and given a certificate of registration if he shall present a certified copy of certificate of registration or license which has been issued to said applicant within the states, territories, districts or provinces of the United States where the requirements for registration shall be deemed by the Board of Registration in Medicine to be equivalent to those of this act, and shall otherwise conform to the rules and regulations agreed upon between the State Board of which he is a licentiate and said board relative to the recognition and exchange of certificates between states: The fee for registration from applicants of this class shall be fifty dollars. . . . .

SECTION 4.—The person receiving a certificate of registration shall file the same, or a certified copy thereof, with the county clerk in the county where he resides, and said clerk shall file said certificate or the certified copy thereof, and enter a proper memorandum thereof in a book to be provided and kept for that purpose, and may collect therefor a fee of fifty cents for each certificate or copy thus filed. And said county clerk shall, on the first day of each month, furnish to the secretary of said board a list of certificates filed in his office during the preceding month on a blank provided for that purpose, and upon notice to him of the change of location or death of a person granted a certificate, or upon the revocation of the certificate granted such person, said county clerk

shall enter at the appropriate places in the record so kept by him a memorandum of said facts; so that the record so kept by said county clerk shall correspond with the records of said board, so kept by the secretary thereof. In case a person having thus filed a certificate shall remove into another county of the State, he shall procure from said county clerk a certified copy of said certificate, and file the same with the said county clerk of the county to which he shall so remove. Said county clerk shall file and enter the same with like effect, as if the same was the original certificate.

MINNESOTA

Physicians and Surgeons. Revised Laws of 1905.

§2295. *Board of Medical Examiners.*—The state board of medical examiners shall consist of nine qualified resident physicians, appointed by the governor each for the term of three years and until his successor qualifies. No members thereof shall serve for more than two successive terms, nor shall any instructor or person financially interested in a medical school be appointed thereto, and it shall at all times include three homeopathic physicians. Vacancies shall be filled by like appointment for the unexpired term. The board shall elect from among their number a president, a secretary, and a treasurer, and shall adopt a seal. It shall hold examinations at the seat of government on the first Tuesday in January, April, June and October of each year, and at such other times as it shall deem best. The secretary shall keep a record of all its proceedings, including a register of all applicants for license, giving their ages, a description of their education in medicine, and the result of their examination. Said books and register shall be prima facie evidence of all the matters therein recorded.

§2296. *Examination and License.*—A person not already authorized to practice medicine in the State, and desiring so to do, shall apply to the secretary of the board for examination, and pay a fee of ten dollars for the use of the board, which in no case shall be refunded. At a time appointed, or at the next regular examination, he shall prove that he has completed four entire sessions of twenty-six weeks each at a medical school recognized by the board, no two sessions having been held in one year; or, if such attendance was prior to the year 1899, three sessions shall suffice. He shall be examined in anatomy, chemistry, histology, obstetrics, pathology, physiology, preventive medicine, the diagnosis and treatment of medical and surgical diseases, and such other branches as the board shall deem advisable. After such examination the board, if seven members thereof consent, shall grant him a license to practice medicine. The examination shall be both scientific and practical, and shall thoroughly test the fitness of the candidate. All answers concerning the treatment peculiar to any school of medicine shall be examined, and their sufficiency passed upon, by the members of the board belonging to that school, and their recommendations thereof shall be final. The board may refuse to grant a license to, or may revoke the license of, any person guilty of immoral, dishonorable, or unprofessional conduct, but subject to the right of the applicant to appeal to the governor.

§2297. *Physicians from Other states, How Licensed.*—The board, either with or without examination, upon receipt of a fee of ten dollars, may grant a license to any physician licensed to practice by the similar board of another state.

§2298. *Record of Licenses—Report to Secretary.*—Before engaging in practice, the holder of a license shall file the same for record with the clerk of the district court in the county where he resides. Upon removal to another county, he shall there file his license in like manner before engaging in practice therein. Such clerk shall keep, in the record book of such licenses, an index thereof, showing the date and page of record, and in January of each year shall furnish to the secretary of the board a list of licenses so filed. Upon notice to the clerk of the death or removal of a license, or of the revocation of a license, he shall note the same upon the record of such license.

§2299. *Exemptions.*—This subdivision shall not apply to commissioned surgeons of the United States army or navy, to physicians from other states in actual consultation here, or to students practicing under the direct supervision of a preceptor while they are enrolled in and regularly attending a recognized medical school.

§2300. *Practicing Without License.*—Every person not heretofore authorized by law so to do who shall practice medicine in the state without having obtained the license herein provided for, and every person who shall so practice contrary to any provision of that subdivision, shall be guilty of a misdemeanor, the minimum punishment whereof shall be a fine of fifty dollars, or imprisonment for ten days. Any person shall be regarded as practicing within the meaning of this subdivision, who shall append the letters "M. D." or "M. B." to his name, or for a fee prescribe, direct or recommend for the use of any person any drug or medicine or other agency for the treatment or relief of any wound, fracture or bodily injury, infirmity or disease; provided that this section shall not apply to dentists.

Laws 1905. Chapter 236.

An Act Authorizing Physicians from Other States to Practice Medicine in Minnesota.

Be it enacted by the Legislature of the State of Minnesota:

§1.—That the state medical examining board, either with or without examination, may grant a license to any physician licensed to practice by a similar board of another state, and who holds a certificate of registration showing that an examination has been made by the proper board of any state in which an average grade of not less than seventy-five percent was awarded the holder thereof, the said applicant and holder of such certificate having been at the time of said examination the legal possessor of a diploma from a medical college in good standing in this state, which said dipoma may be accepted in lieu of an examination, as evidence of qualification. In case of scope of said examination

was less than that prescribed by this state the applicant may be required to submit to an examination in such subjects as have not been covered. The fee for each examination shall be fifty ($50) dollars.

A certificate of registration or license issued by the proper board of any state may be accepted as evidence of qualification for registration in this state, *provided*, the holder thereof was at the time of such registration the legal possessor of a diploma issued by a medical college in good standing in this state and that the date thereof was prior to the legal requirements of the examination test in this state.

§2.—If by the laws of any state or the rulings or decisions of the appropriate officers on boards thereof in any burden, obligation, requirement, disqualification or disability is put upon physicians registered in this state or holding diplomas from medical colleges in this state which are in good standing therein, affecting the right of said physicians to be registered or admitted to practice in said state, then the same or like burdens, obligations, requirements, disqualifications or disability shall be put upon the registration in this state of physicians registered in said state or holding diplomas from medical colleges situated therein.

Approved April 18, 1905.

MISSISSIPPI

THE LAW REGULATING THE PRACTICE OF MEDICINE IN THE STATE OF MISSISSIPPI. CODE OF 1906, CHAPTER 110.

3681. *Duty to Obtain License.*—Every person who desires to practice medicine must first obtain a license to do so from the State Board of Health; but this section shall not apply to physicians now holding permanent license, the same having been recorded as required by law. (For penalty see 1334: If any person shall practice as a physician or surgeon, without having first been examined and obtained a license as required by law, he shall, on conviction, be fined not less than twenty dollars nor more than two hundred dollars, or be imprisoned in the county jail not exceeding thirty days.)

3682. *How License Obtained.*—Every person who desires to obtain a license to practice medicine must apply therefor, in writing, to the State Board of Health, and must be examined by said board touching his learning in the following branches of medicine only, viz.: Anatomy, chemistry, obstetrics, materia medica, physiology, pathology, surgery and hygiene; and, if the applicant be found by the board, upon examination, to possess sufficient learning in said branches and be of good moral character, the board shall at once issue to him a license to practice medicine, which shall be signed by each member who approves of its issuance.

3683. *Application for License; What to Contain.*—The application for license must state: (1) The applicant's name in full; (2) his place of residence and post office address; (3) his nativity and age; (4) the time spent by him in medical studies; (5) the name and post office address of the preceptor under whom medical studies were pursued; (6) courses of medical lectures attended; (7) name of medical school attended; (8) if a graduate of a medical college, name thereof; (9) time spent in a hospital; (10) time spent in the practice of medicine, if any; (11) school or system of practice chosen, and (12) references as to his personal character.

3684. *Examinations, When, Where and How Conducted.*—The State Board of Health shall meet at the Capitol twice in each year, at such time as may be designated by the board, for the purpose of examining applicants for license to practice medicine, and shall continue in session until all applicants are examined and the examinations are approved or disapproved. All applications as to applicant's learning shall be upon written questions and answers, and distinction shall not be made between applicants because of the different systems or schools of practice that may be chosen.

3685. *Fees for Examination.*—Every person who shall apply for license to practice medicine, shall, before he will be entitled to be examined, pay a fee of ten dollars and twenty-five cents, of which ten dollars are to be divided equally between those members of the Board who attend and conduct the examination of the applicant, and twenty-five cents to be paid to the Secretary of the board for filing and preserving the application for license.

3686. *Form of License.*—A license to practice medicine may be of such form as the State Board of Health may prescribe, but it shall contain a statement showing the place of residence, post office address, and qualifications of the applicant, both as to learning and moral character.

3687. *License Must Be Recorded; Effect of Failure.*—Every person who receives a license to practice medicine must file it in the office of the Clerk of the Circuit Court of the county in which he resides within sixty days from the date of its issuance; otherwise it shall become void. When the license is filed the Clerk shall record the same, with his certificate of the filing thereto attached, in a suitable book to be kept in his office for that purpose, upon the payment by the licensee of the fee provided by law, and when recorded he shall deliver the original, on demand to the licensee. Whenever, the licensee shall change the county of his residence and of usual practice, he must, under like penalty, file the original or a certified copy of the license, or of the record thereof, in the office of said Clerk, in the county into which he shall move and practice, within sixty days of the time of such removal, to be there recorded in like manner and under like penalty.

3688. *Lost License May Be Supplied.*—If a license to practice medicine be issued and be lost, the State Board of Health may issue a duplicate license in lieu of the one lost.

3689. *Temporary License.*—The Secretary of the State Board of Health may issue under his signature a temporary license to any one to practice medicine, which shall be valid until the next succeeding meeting of the board for examining applicants; and such license will show the date of its issuance, otherwise it shall be void. Only one temporary license shall ever be issued to the same person, and it shall always be made to an individual, and not to a partnership. The Secretary shall be entitled to twenty-five cents for such license, and the same shall be recorded as a permanent license is required to be, under like penalty for failure.

3690. *Females Practicing Midwifery.*—. . . . .

3691. *Practice of Medicine Defined.*—The practice of medicine shall mean to suggest, recommend, prescribe, or direct for the use of any person, any drug, medicine, appliance or other agency, whether material or not material, for the cure, relief, or palliation of any ailment or disease of the mind or body, or for the cure or relief of any wound or fracture or other bodily injury or deformity, or the practice of obstetrics or midwifery, after having received, or with the intent of receiving therefor,

either directly or indirectly, any bonus, gift, profit or compensation; provided, that nothing in this section shall apply to females engaged solely in the practice of midwifery.

3692. *Non-Residents.*—Licensed physicians who reside without this State and whose practice of medicine extends into it, may obtain license to practice medicine in this State without being examined as to their learning, by presenting a written application for license, in the form prescribed, to the State Board of Health; whereupon the Secretary of the board shall issue to the applicant a license in the name of the board, for which the Secretary shall be entitled to receive a fee of twenty-five cents, and the license shall be recorded as hereinbefore provided in each county in which the licensee shall practice, with like penalty for a failure to record as in case of a resident physician. That non-resident physicians not holding license from the state shall not be permitted to practice medicine under any circumstances after remaining in the state five days, except when called in consultation by a licensed physician residing in this state; except as provided in section 3693.

3693. *License from Another State Recognized.*—The board of health may grant license to practice medicine without examination as to learning to graduates in medicine who hold license to practice medicine from another state, provided the requirements in such state are equal to those required by the state board of health of this state.

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3695. *Communications Privileged.*—All communications made to a physician or surgeon by a patient under his charge or by one seeking professional advice, are hereby declared to be privileged, and such physician or surgeon shall not be required to disclose the same in any legal proceeding, except at the instance of the patient.

MISSOURI

STATUTES 1906. CHAPTER 128. MEDICINE SURGERY AND DENTISTRY.

SEC. 8518 1. *Practitioner Shall Be A Registered Physician.*—It shall be unlawful for any person not now a registered physician within the meaning of the law to practice medicine or surgery in any of its departments, or to profess to cure and attempt to treat the sick and others afflicted with bodily or mental infirmities, or engaged in the practice of midwifery in the state of Missouri, except as hereinafter provided.

SEC. 8518 2. *State Board of Health to have General Supervision Over Registration of Practitioners.*—The state board of health shall have general supervision over the registration of all practitioners of medicine, surgery and midwifery in this state. (Laws 1901, p. 207.)

SEC. 8518 3. *Examination of Applicants for Registration, How Conducted, License to Practice Granted, When—Practitioners Holding Certificates from Other States.*—(As amended by Laws 1907.) All persons desiring to practice medicine or surgery in this state, or to treat the sick or afflicted as provided in section one of this act, shall appear before the state board of health at such time and place as the board may direct, and shall there be examined as to their fitness to engage in such practice. All persons appearing for examination shall make application, in writing, to the secretary of said board thirty days before the meeting. They shall furnish satisfactory evidence of their preliminary qualifications, to wit: A certificate of graduation from an accredited high school or state normal school, college, university or academy, a certificate from the county school commissioners, certifying that they have satisfactorily passed an examination equivalent to a grade from an accredited high school or state normal school, college, university or academy. They shall also furnish satisfactory evidence of having received diploma from some reputable medical college of four years' requirements at the time of graduation: Provided, that the time of graduation has been since March 12, 1901, and two years' requirements, if the date of graduation is prior to March 12, 1901, and shall also furnish evidence of good moral character. The medical examination may be made in whole or in part, in writing, and shall be of elementary and practical character, but sufficiently strict to test the qualifications of the candidate as a practitioner, and shall embrace the subjects of anatomy, chemistry, physiology, therapeutics, obstetrics, gynecology, surgery, practice of medicine, bacteriology, medical jurisprudence and hygiene, and such other branches as the state board may direct. Provided, that each applicant for license shall have two hours, if necessary, during which

to answer the usual number of questions asked on each branch examined upon. The candidate shall be required to answer seventy-five percent of such questions as are asked him before being granted a certificate: Provided, however, that the examination of any applicant in therapeutics shall be conducted by the member or members of said board who represent the system of medicine of which said applicant has been a student. If there shall be no representative of the school or system of which the applicant has been a student, the examination in therapeutics shall be conducted by an examiner appointed for that purpose by the governor of Missouri, but all examinations other than that in therapeutics shall be conducted as heretofore provided in this act. The board of health shall issue to such persons as they shall find upon examination to possess the requisite qualifications a license to practice medicine and surgery in accordance with the provisions of this act, and the state board of health shall not be permitted to favor any particular school or system of medicine, but all applicants shall be subjected to the same examination, and the same degree of proficiency shall be required of all. The board shall examine persons applying for a license, although such persons cannot speak the English language, the applicant in all such cases to pay the expenses of an interpreter satisfactory to the board.

8518 4. *License to be Recorded with County Clerk—Fee for Recording—Neglect to Record License a Misdemeanor—Penalty.*—Every person holding a license from the state board of health shall have it recorded in the office of the county clerk of the county in which he resides, and the record shall be endorsed thereon. And the clerk is authorized to charge a fee of one dollar for recording each license, to be paid by the person offering such license for record. Any person removing to another county to practice medicine or surgery shall have his license recorded in the county which he removes to, and the holder of said license shall pay said clerk of said county the usual fee for making the record. The county cleark shall keep in a book provided for that purpose a complete list of the licenses recorded by him with the date of issue. Any person neglecting for twenty days to record his license as in this section provided, after entering upon the practice, shall be guilty of a misdemeanor, and on conviction thereof shall be fined not less than ten dollars nor more than fifty dollars, and on failure to record said license for thirty days after such conviction, such person shall be reliable to a fine of not less than one hundred dollars.

Sec. 8518 5. *Violation of Act and Penalty.*—(Amended in 1907.)

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Sec. 8518 6. *Fees and Disposition of Same.*—In order to provide the means to carry out and maintain the provisions of this act, the said board shall charge each person applying to and appearing before it for examination for a license to practice medicine and surgery a fee of fifteen dollars, and should such examination prove unsatisfactory and the state board refuse to issue a license thereon, the applicant failing

to pass such examination may return at any meeting within the next twelve months thereafter and be examined without extra charge, but no temporary license shall be issued to such person. . . . .

SEC. 8518 7. *License—May be Refused Whom.*—(As amended by Laws 1907.)

SECTION 7.—The board may refuse license to individuals guilty of unprofessional or dishonorable conduct, and they may revoke licenses for like cause, after giving the accused an opportunity to be heard in defense before the board. Habitual drunkenness or excessive use of narcotics or producing criminal abortion, shall be deemed unprofessional and dishonorable conduct within the meaning of this section, but this specification is not intended to exclude all other acts for which licenses may be revoked, but any person whose license has been or shall be revoked by the board, shall have the right to appeal from the decree, decision or judgment of the board revoking such license, to the circuit court of the county in which such board may have held its meeting and revoked such license; and such appeal shall be allowed and granted upon the affidavit of the person whose license shall have been revoked, or his agent or attorney, which affidavit shall be in the form now required in cases of appeal from courts of record; said cause, together with a complete transcript and record of all proceedings had therein, shall be certified by the secretary of the board to such circuit court and such court shall hear and try same as ordinary civil actions, but if the decree, decision or judgment of said board revoking such license shall be upheld or affirmed by the circuit court, such decree, decision and judgment of such board shall be in full force and such license shall stand revoked, pending any appeal from the decree or decision of such circuit court, and until the decree or judgment of such circuit court shall be reversed or set aside."

SEC. 8518 8. *Health Commissioner of St. Louis to Perform what Duties.*—. . . .

SEC. 8518 9. *Act does not Apply to Whom—Gratuitous Service Exempt—Graduates of Medical Schools Licensed to Practice, When.*—It is not intended by this act to prohibit gratuitous service to and treatment of afflicted and this act shall not apply to commissioned surgeons of the United States army, navy, public health and marine hospital service. (As amended by Laws 1907.)

SEC. 8518 10. *Midwifery—License to Practice—Violation of Law a Misdemeanor—Penalty.*—. . . .

SEC. 8518 11. *Inconsistent Acts Repealed.*—. . . .

MONTANA

Code (1895). Chapter 16.

§600.—. . . .

§601.—. . . . The board of examiners must hold meetings for examinations at the seat of government on the first Tuesday of April and October of each year, and at such other times and at the same and other places as the board may determine.

§602.—Every person hereafter wishing to practice medicine or surgery in any of their departments in this state, shall apply to said board for a certificate so to do. Every person applying shall present his or her diploma to the said board of examiners for verification as to its genuineness: if the diploma is found genuine and is issued by a medical school legally recognized and in good standing, whose teachers are graduates of a legally organized school, which acts the said board of examiners shall determine, and if the person presenting and claiming said diploma by the person to whom the same was originally granted; at a time and place designated by said board, or at a regular meeting of said board, said applicant shall submit to an examination in the following branches, to wit: Anatomy, physiology, chemistry, histology, materia medica, therapeutics, preventive medicine, practice of medicine, surgery, obstetrics, diseases of women and children, diseases of the nervous system, diseases of the eye and ear, medical jurisprudence, and such other branches as the board may deem advisable, and present evidence of having attended four courses of lectures at least six months each, but such evidence of having attended four courses of lectures shall not be required of applicants graduating prior to July 1, 1898; said board shall cause such examination to be both scientific and practical, but of sufficient thoroughness and severity to test the candidate's fitness to practice medicine and surgery; when desired, such examination may be conducted in the presence of the dean of any medical school, or the president of any medical society in this state. After examination, such board shall, if the canditate has been found qualified, grant a certificate to such candidate to practice medicine and surgery in the state of Montana; which said certificate shall only be granted by the consent of not less than four members of the said board, and which said certificate shall be signed by the president and secretary of said board and attested by the seal thereof; *provided*, however, that during the intervening period of the sessions of the board any person desiring to practice medicine in this state may present his or her diploma to the president or secretary of the board, who may issue a certificate good until the next regular meeting of the board; *and provided further*, that all physicians and sur-

geons who hold certificates granted by the now existing board of medical examiners shall be exempt from the provisions of this section.

§603.—The board may refuse to grant a certificate for unprofessional dishonorable or immoral conduct. Before a certificate can be refused for such cause, the board must serve in writing upon the applicant a copy of any charge or charges against him, and appoint a day for hearing, at which the applicant or any witness in his behalf may appear and give testimony in refutation in such charges. . . . .

§604.—Every person obtaining a certificate from the board, must, within sixty days from the date thereof, have the same recorded in the office of the county clerk in the county wherein he resides; if he removes from one county to another to practice medicine or surgery, his certificate must immediately be recorded in the county to which he removes. The county clerk must indorse upon the certificate the date of record, and he is entitled to charge and receive his usual fees for such services, the fee to be paid by the applicant. Until the certificate be recorded, as provided by this section, the physician practicing under it is subject to the penalties prescribed in the penal code for practicing without a certificate.

§605.—This act shall not apply to midwives of skill and experience, commissioned surgeons of the United States army and navy in the discharge of their official duties; nor to physicians and surgeons in actual consultation from other states and territories

§606.—. . . . .

§607.—Candidates for examination shall pay in advance to the secretary of the board of medical examiners a fee of fifteen dollars, which fee shall defray the entire expense of said candidates for examination before the aforesaid board of examiners. Any one failing to pass the required examination shall be entitled to a second examination within six months, without fee. And the moneys so received shall be turned over the state treasurer, to be by him deposited in the medical board fund, as hereinbefore provided.

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NEBRASKA

SYNOPSIS OF NEBRASKA MEDICAL PRACTICE ACT. STATUTES 1905.

§4321. *Who May Practice.*—It shall be unlawful for any person to practice medicine, surgery or obstetrics, or any of the branches thereof, in this State, without first having applied for and obtained from the State Board of Health a license so to do. Application therefor shall be made in writing, and shall be accompanied by the examination fees hereinafter specified and with proof that the applicant is of good moral character. Applications from candidates who desire to practice medicine and surgery in any or all of their branches shall be accompanied by proof that the applicant is a graduate of a medical school or college in good standing, as defined in Section Eight (8) of this Article. When the application aforesaid has been inspected by the Board and found to comply with the foregoing provisions, the Board shall notify the applicant to appear before it for examination at the time and place mentioned in such notice. Examination may be wholly or in part in writing by the Board and shall be of a character sufficiently strict to test the qualifications of the candidate as a practitioner. The examination of those who desire to practice medicine and surgery in any or all their branches shall embrace those subjects and topics, a knowledge of which is commonly and generally required of candidates for the degree of doctor of medicine, by reputable medical colleges in the United States. All examinations provided for in this act shall be conducted under rules and regulations prescribed by the board, which shall provide for a fair and wholly impartial method of examination. It is also provided that examinations on practice of medicine and therapeutics shall be conducted by the member, or members, of the Board of Secretaries, who are of the same school of medicine as that of the applicant. And it is further provided, that the said State Board of Health, may at their discretion, admit, without examination, legally qualified medical practitioners, who hold certificates to practice medicine in any state with equal requirements to those of the state of Nebraska.

§4322. *Medical School Defined.*—The term medical school or college in good standing, shall be defined as follows, to wit: a medical school or college requiring a preliminary examination for admission to its course of study in all the common branches, and in Latin and the higher mathematics, which requirements shall be regularly published in all the advertisements and in each prospectus or catalogue issued by said school, which medical school or col-

lege shall also require as a requisite for granting the degree of M. D., attendance upon at least four courses of lectures of six months each, no two of said courses to be held within one year, and having a full faculty of capable professors in all the different branches of medical education, to wit: anatomy, physiology, chemistry, toxicology, pathology, hygiene, materia medica, therapeutics, obstetrics, bacteriology, medical jurisprudence, gynecology, principles and practice of medicine and surgery and specially requiring clinical instruction in the two last named of not less than four hours per week in each during the last two courses of lectures: *provided*, That this four years clause shall not apply to degrees granted, or to be granted, prior to August, 1898.

Diplomas.—It shall be the duty of all persons intending to practice medicine, surgery or obstetrics in the state of Nebraska before beginning the practice thereof, in any branch thereof, to present his diploma to said board, together with his affidavit that he is the lawful possessor of the same, that he has attended the full course of study required for the degree of M. D. and that he is the person therein named. Such affidavit may be taken before any person authorized to administer oaths, and the same shall be attested under the hand and official seal of such official, if he has a seal, and any person swearing falsely in such affidavit shall be guilty of perjury and subject to the penalty therefor.

§4323. *License—Certificate—Register.*—If upon investigation of the proofs submitted by the Board, and after the examination, as hereinbefore provided, the applicant shall be found entitled to practice, there shall be issued to said applicant the certificate of said board under its seal and signed by its secretaries stating such fact, and it shall be the duty of the applicant before practicing to file such certificate or a copy thereof in the office of the County Clerk in the County in which he or she resides or in which he or she intends to practice; such certificate or copy shall be filed by the County Clerk and by him recorded in a book kept for that purpose, properly indexed, to be called the "Physicians' Register" and for such services the County Clerk shall receive from the applicant the same fees as are allowed to the Register of Deeds for the recording of conveyances.

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§4326. *Removal from County.*—Any person who shall obtain a certificate provided by this act and shall remove to another county shall before the entering upon the practice of his profession in such other county cause said certificate to be filed and recorded in the office in the County clerk of the county to which he has removed.

§4327. *Certificate—Refusal—Revocation.*—The board may refuse to issue a certificate, or may revoke one already issued for any of the causes defined in this section, to wit: the employment of fraud or deception in applying for license or diploma or in passing the examination provided for in this act; conviction of crime involving moral turp-

itude; habitual intemperance in the use of ardent spirits, narcotics or stimulants; unprofessional or dishonorable conduct. "Unprofessional or dishonorable conduct," as used herein, are declared to mean First, the procuring or aiding or abetting in procuring a criminal abortion; Second, the obtaining of a fee on the assurance that a manifestly incurable disease can be permanently cured; Third; betrayal of a professional secret to the detriment of a patient; Fourth, causing the publication and regulation of advertisements of any medicine or means whereby the monthly periods of women can be regulated or the menses can be re-established, if suppressed; Fifth, causing the publication and regulation of advertisements of any kind relative to diseases of the sexual organs tending to injure the morals of the public.

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§4329. *Unlawful Practicing—Penalty.*—Any person not possessing the qualifications for the practice of medicine, surgery or obstetrics required by the provisions of this act, or any person who has not complied with the provisions of this act who shall engage in the practice of medicine, surgery or obstetrics, or any of the branches thereof in this State, shall be deemed guilty of a misdemeanor and on conviction thereof shall be fined in any sum not less than fifty ($50) dollars nor more than three hundred ($300) dollars, and costs of prosecution for each offense and shall stand committed until such fine and costs are paid.

§4330. *Practitioner Defined—Exceptions.*—Any person shall be regarded as practicing medicine within the meaning of this act who shall operate or profess to heal or prescribe for or otherwise treat any physical or mental ailment of another. But nothing in this act shall be construed to prohibit gratuitous services in cases of emergency, and this act shall not apply to commissioned surgeons in the United States Army and Navy, nor to nurses in their legitimate occupations, nor to the administration of ordinary household remedies.

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§4332. *Fees.*—Every holder of a diploma from a recognized medical college within the state of Nebraska, making application for an examination and certificate under the provisions of this Act, shall pay to the Board of Secretaries prior to his examination the sum of ten ($10.00) dollars. All other persons making such application shall pay to said Board the sum of twenty-five ($25.00) dollars. All such fees shall be equally divided among the four secretaries of the Board as full compensation for their services and expenses. For the taking of any testimony each of the secretaries shall be entitled to charge and receive such fees as are provided for notaries public for similar services. No part of such fees shall be paid out of the state treasury.

This act shall take effect and be in force from and after August 1st, 1903.

Special Rules of Board.

Each applicant for examination must present to the Board letters of recommendation from two registered physicians of the state or such others as may be satisfactory to the Board.

No medical school recognized by the Board unless said school is recognized by the Association of Medical Colleges of the School of Practice to which it belongs.

Applications must be on file at least ten days before the date of examination.

NEVADA

EXTRACTS FROM THE MEDICAL PRACTICE ACT OF NEVADA. APPROVED MARCH 4, 1905.

SECTION 1.—That it shall hereafter be unlawful for any person, or persons, to practice medicine, surgery or obstetrics in this State without first obtaining a license so to do as hereinafter provided.

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SEC. 6.—. . . . All certificates issued by said Board shall bear its seal and the signatures of its President and Secretary, and shall authorize the person to whom it is issued to practice medicine in all its branches in this State, upon complying with the requirements of this Act. Said Board may, in its discretion, accept and register, upon payment of the registration fee, and without examination of the applicant any certificate which shall have been issued to him by the medical examining board of the District of Columbia, or of any State or Territory of the United States; *provided, however,* that the legal requirements of such medical examining board shall have been, at the time of issuing such certificate, in no degree or particular less than those of Nevada at the time when such certificate shall be presented for registration to the Board created by this Act; *and provided further,* that the provisions in this paragraph contained shall he held to apply only to such of said medical examining board as accept and register the certificates granted by this board without examination by them of the ones holding such certificates.

SEC. 7.—After this law goes into effect, any person desiring to practice medicine, surgery, or obstetrics or any of the various branches of medicine in this State, shall, before beginning to practice, procure from the State Board of Medical Examiners a certificate that such person is entitled to practice medicine, surgery, or obstetrics in this State. In order to procure such certificate the applicant shall submit to the said Board his or her diploma, issued by some legally chartered medical school, the requirements of which medical school shall have been at the time of granting such diploma in no particular less than those prescribed by the Association of American Medical Colleges for that year, and he must accompany said diploma or license with an affidavit setting forth the number and duration of terms the applicant was required to be in attendance, and that he is the lawful possessor of the same, that he is the person therein named, and that the diploma or license was procured without fraud or misrepresentation of any kind. Such application shall

be accompanied by the affidavit of two freeholders, resident of the same county in which the applicant resides, stating that the applicant is the identical person named in the accompanying diploma, and that he or she is of good moral standing and reputable. In addition to such affidavit, said Board may hear such further evidence as, in its discretion, it may deem proper as to any of the matters embraced in said affidavit. If it should appear from such evidence that said affidavit is untrue in any particular, or if it should appear that the applicant is not of good moral character, the application must be rejected. Said Board shall retain such diploma such time as is necessary, but in no case shall said Board retain such diploma to exceed two weeks. All such diplomas and affidavits shall be addressed to the Secretary of the Board.

SEC. 8.—Applicants for certificates to practice medicine, surgery, or obstetrics in the State of Nevada, shall be required to present a diploma from a legally recognized college, and to pass a satisfactory examination before the State Board of Medical Examiners as to his or her qualifications. The applicant must appear personally before the Board, and the examination shall be conducted in the English language, and shall be, in whole or in part, in writing, and in each branch shall obtain seventy-five per cent., and shall be on the following subjects, to wit: Anatomy, physiology, materia medica, and therapeutics, chemistry, bacteriology, pathology, toxicology, obstetrics, surgery, general medicine, diseases of the skin, eye, ear, nose, throat, brain and the genito-urinary system. Said examination shall be fair and impartial, and the questions of such a character as will determine the fitness of the applicant to practice his, or her, profession. When applicant applies for examination in materia medica and therapeutics, and theory and practice of medicine, he shall designate in what school of medicine he desires to practice, and only the member or members of the Board who belong to the school so designated shall participate in this part of the examination. Examinations shall be practical in character, and designed to discover the applicant's fitness to practice medicine and surgery. If an applicant fail in his first examination, he may, after not less than six months, be re-examined without additional fee. If he fail in a second examination he shall not thereafter be entitled to another examination in less than one year after the date of second examination, and shall be required to pay for such examination the full fee. The examination papers shall form a part of the records of said Board, and shall be kept on file by the Secretary, and such records shall be open to public inspection whenever requested, after the examination. Each applicant, on making application, shall pay to the secretary of the Board a fee of twenty-five ($25) dollars at the same time the diploma and affidavit is filed with him, and this fee shall not be returned in the event of the applicant's failing to pass a satisfactory examination. Any person who may hereafter be granted a license to practice medicine and surgery in this State under this Act upon the grounds of reciprocity with other States and without examina-

tion, shall pay a fee of twenty-five ($25) dollars for such license. [As amended March 20, 1907.]

Sec. 9.—Any unsuccessful applicant shall have the right to appeal to the courts, requiring the said Board to show cause why such applicant should not be permitted to practice medicine, surgery or obstetrics in the State of Nevada.

Sec. 10.—Said Board shall procure a book for the purpose of recording the names of all persons to whom it issued certificates. In this book shall be entered the names of the applicants, together with the name of the school granting the diploma, the date of the diploma, the number of terms the applicant attended school, residence of applicant, and the date of issuance of certificate. This book shall be retained by the Secretary, who shall note the unsuccessful applicants, furnishing the same information as is given above. The Secretary shall furnish each County Clerk in this State a complete list of persons to whom certificates have been issued, after each meeting of the Board. Such list shall be retained and filed by the County Clerk, and it shall show the name, age, and location of the holder of each certificate, together with the name of the Institution conferring the degree, and the date of the issuance of certificate.

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Sec. 12.—Every person to whom the Board shall issue a certificate shall present the same to the County Recorder of the county in which he desires to practice, and have the same recorded, and shall pay the fee usually paid for recording such papers. The Board may refuse a certificate to any applicant guilty of unprofessional conduct, and may revoke any certificate for a like cause. In all cases of refusal or revocation the party aggrieved may appeal to the courts. The words "unprofessional conduct" as used in this act are hereby declared to mean. . . . .

Sec. 13.—For the purposes of this Act the words "practice of medicine, surgery and obstetrics" shall mean to open an office for such purpose, or to announce to the public, or to any individual in any way, a desire or willingness, or readiness to treat the sick or afflicted in any county in the State of Nevada; or to investigate or diagnosticate, or to offer to investigate or diagnosticate an physical or mental ailment, or disease of any person, or to give surgical assistance to, or to suggest, recommend, prescribe or direct for the use of any person, any drug, medicine, appliance or other agency, whether material or not material, for the cure, relief or palliation of any ailment or disease of any wound, fracture, or bodily injury or deformity, after having received or with the intent of receiving therefor, either directly or indirectly, any money, gift, or any other form of compensation. It shall also be regarded as practicing medicine within the meaning of this Act if anyone shall use in connection with his or her name the words or letters "Dr.," "Doctor," "Professor," "M. D.," or "Healer," or any other title, word, letter or other designation intended to imply or designate him or her as a practitioner

of medicine, or surgery, or obstetrics in any of its branches; *provided*, that nothing in this Act shall be construed to prohibit gratuitous services of druggists or other persons in cases of emergency, or the domestic administration of family remedies, and this Act shall not apply to commissioned surgeons of the United States Army or Navy in the discharge of their official duties, nor shall it apply to professional or other nurses in the discharge of their duties as nurses, nor to physicians who are called into this State for consultation, and who are legally qualified to practice in the State where he or she resides. In charging any person in an affidavit, information or indictment with a violation of this Act by practicing medicine, surgery or obstetrics without a license, it shall be sufficient to charge that he or she did, upon a certain day, and in a certain county of this State, engage in the practice of medicine, he or she, not having a license to do so, without averring any further or more particular facts concerning the same.

SEC. 14.—Any person who shall practice medicine, surgery or obstetrics in this State without first complying with the provisions of this Act, shall be deemed guilty of a misdemeanor, and upon conviction there of, shall be punished by a fine of not less than one hundred ($100) dollars, nor more than two hundred ($200) dollars, or by imprisonment in the county jail for not less than fifty (50) days, nor more than one hundred and eighty (180) days, or by both such fine and imprisonment for each and every such offense. Any person may institute proceedings at law provided for in this Act.

SEC. 15.—Every person filing for record, or attempting to file for record, the certificate issued to another, falsely claiming himself to be the person named in such certificate, or falsely claiming himself to be the person entitled to the same, shall be guilty of felony, and, upon conviction thereof, shall be punished by imprisonment in the State Prison not less than one year nor exceeding five years.

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SEC. 17.—Every person practicing medicine, surgery or obstetrics in the State of Nevada on the first Monday of May, 1905, shall submit to the said Board his, or her, diploma for registration, and a fee of twenty-five ($25) dollars shall accompany such diploma; *provided*, that the owner of such diploma shall, if he or she was practicing medicine, surgery or obstetrics prior to the passage of the Act approved March 15, 1899, and has not complied with said Act of March 15, 1899, pay a fee of five ($5) dollars for such registration, but said person shall submit to the Board said diploma on the first Monday of May, 1905; *provided further*, that all persons that have complied with the Act of March 15, 1899, shall be entitled to full registration by the said Board of Medical Examiners, and nothing in this Act shall be construed to prevent such registration, and the Secretary of said Board shall enter free of all charge, upon the record book of said Board, the names of all persons who have complied with the Act of March 15, 1899. *And be it further provided*, that a cer-

tificate of registration or license issued by the proper examining board of any state, which agrees on reciprocal registration with this State, may be accepted as evidence of qualification for reciprocal registration in this State; *provided*, that the holder of such certificate was, at the time of such registration, the legal possessor of a diploma issued by a medical college in good standing in this State, and that the date thereof was prior to the passage of this Act.

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SEC. 19.—This Act shall take effect from and after the third day of May, nineteen hundred and five.

NEW HAMPSHIRE

EXTRACTS FROM THE LAWS OF NEW HAMPSHIRE. Approved March 16, 1897.

An Act to regulate the licensing and registration of physicians and surgeons.

Be it enacted by the senate and house of representatives in general court convened:

SECTION 1.—No person shall hold himself out to the public as a physician or surgeon, or advertise as such, or use the title of M. D. or Dr. (or any title which will show or tend to show that the person using the same is a practitioner of any of the branches of medicine) in New Hampshire after September 1, 1897, unless previously registered and authorized, or unless licensed and registered as required by this chapter; nor shall any person practice medicine and surgery whose authority to practice is suspended or revoked by the agent of a state board.

SEC. 2.—Within sixty days after the passage of this act, the governor and council shall appoint three separate state boards of medical examiners, of five members each, so appointed that the term of office of one member shall expire each year, and the members thereafter appointed shall hold office five years, or until their successors are appointed and qualified. One board shall represent the New Hampshire Medical Society, one the New Hampshire Homeopathic Medical Society, and one the New Hampshire Eclectic Medical Society. . . . .

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SEC. 7.—The regent shall admit to examination any candidate who pays a fee of $10 and submits satisfactory evidence, verified by oath, if required, that he,

1. Is more than twenty-one years of age.

2. Is of good moral character.

3. Has graduated from a registered college; or satisfactorily completed a full course in a registered academy or high school; or had a preliminary education considered and accepted by the regent as fully equivalent.

4. Has studied medicine not less than four full school years, of at least nine months each, in four different calendar years, in a medical college registered as maintaining at the time a satisfactory standard. The regent shall accept, as the equivalent for any part of the third and fourth requirements, evidence of five or more years' reputable practice, provided that such substitution be specified in the license.

5. Has either received the degree of bachelor or doctor of medicine

from some registered medical school, or a diploma or license conferring full right to practice medicine in some foreign country.

Students who matriculate in a New Hampshire medical school before January 1, 1898, on the prescribed study of medicine, shall be exempt from this preliminary education required.

SEC. 8.—Each board shall submit to the regent, as required, lists of suitable questions for thorough examinations in anatomy, physiology and hygiene, chemistry, surgery, obstetrics, pathology and diagnosis, and therapeutics, including practice and *materia medica*. From these lists the regent shall prepare question papers for all these subjects, which at any examination shall be the same for all candidates, except that in therapeutics, practice and *materia medica* all the questions submitted to any candidate shall be chosen from those prepared by the board selected by that candidate and shall be in harmony with the tenets of that school, as determined by its state board of medical examiners.

SEC. 9.—Examinations for license shall be given at Concord, in this state, and at least twice annually, and shall be exclusively in writing and in English. Each examination shall be conducted by the regent, or a competent examiner appointed by him, who shall not be one of the medical examiners. At the close of each examination the regent or examiner in charge shall deliver the question and answer papers to the board selected by each candidate, or to its duly authorized committee, and such board, without unnecessary delay, shall examine and mark the answers and transmit to the regent an official report, signed by its president and secretary, stating the standing of each candidate in each branch, his general average, and whether the board recommends that a license be granted. Such report shall include the questions and answers and shall be filed in the public records of the regent. If a candidate fails on first examination, he may, after not less than six months' further study, have a second examination without fee. If the failure is from illness, or other cause satisfactory to the board, they may waive the required six months' study.

SEC. 10.—On receiving from a state board an official report that an applicant has successfully passed the examinations and is recommended for license, the regent shall issue to him a license to practice medicine. Every license shall be issued by the regent under seal, and shall be signed by each acting medical examiner of the board selected, and by the regent, and shall state that the licensee has given satisfactory evidence of fitness as to age, character, preliminary and medical education, and all other matters required by law, and that after full examination he has been found properly qualified to practice. Applicants examined and licensed by other state examining boards registered by the regent as maintaining standards not lower than those provided by this chapter, and applicants who matriculate in a New Hampshire medical school before January 1, 1898, and who receive the degree M. D. January 1, 1903, may, without further examination, on payment

of five dollars to the regent and on submitting such evidence as may be required, receive an indorsement of their licenses or diplomas conferring all rights and privileges of a regent license issued after examination.

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SEC. 11.—(As amended by chapter 1 of the Session Laws of 1903.) This chapter shall not be construed to affect commissioned medical officers serving in the United States army, navy, or marine hospital service, while so commissioned; or any one while actually serving on the resident medical staff of any legally incorporated hospital; or any legally registered dentist exclusively engaged in practicing dentistry; or any manufacturer of artificial eyes, limbs, or orthopedic instruments or trusses in fitting such instruments on persons in need thereof; or any lawfully qualified physician in other states or countries meeting legally registered physicans in this state in consultation; or any physician residing on a border of a neighboring state and duly authorized under the laws thereof to practice medicine therein, whose practice extends into this state, and who does not open an office or appoint a place to meet patients or receive calls within this state; or to the regular or family physicians of persons not residents of this state, when called to attend them during a temporary stay in the state; neither shall the provisions of this act apply to clairvoyants, or to persons practicing hypnotism, magnetic healing, mind cure, massage, Christian science, so called, or any other method of healing if no drugs are employed or surgical operations are performed; *provided*, such persons do not violate any of the provisions of this act in relation to the use of M. D. or the title of doctor or physician.

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SEC. 13.—Every person who is a practitioner of medicine and surgery in this state prior to the passage of this act shall be, upon satisfactory proof thereof to the regent and upon the payment of a fee of one dollar entitled to registration; and the said regent shall issue to him a certificate signed by himself, and the chairman and secretary of such board of medical examiners as the applicant may elect; and said certificate shall state the facts and the cause of said registration, and shall entitle the said person to practice medicine legally in the state of New Hampshire.

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SEC. 15.—This act shall take effect on its passage.

Approved March 16, 1897.

NEW JERSEY

Synopsis of the Requirements for Examination for License to Practice Medicine and Surgery in the State of New Jersey, and of the Penalties Imposed for Unlawful Practice.

All persons beginning the practice of medicine in any of its branches in New Jersey must apply to the State Board of Medical Examiners for a license, either through examination by this Board or through the indorsement of a license issued after a satisfactory and approved examination by another State Board, whose Standard of Requirements is substantially the same as that of this Board, as provided in the Act to Regulate the Practice of Medicine and Surgery, approved May 22, 1894, amended and approved April 8th, 1903.

I. Requirements for Admission to the Examination.

The regular examinations of the Board are held in the Capitol at Trenton, on the third Tuesday, Tuesday evening and Wednesday of June and October. Application for blank forms for the June examination should be made early in May, and for the October examination early in September. These forms must contain satisfactory proof that the applicant meets the following requirements:

1. Name, Residence, Place and Date of Birth, showing that applicant is over 21 years of age.

2. Academic Requirements: Applicants must present satisfactory proof of academic education in one of the following forms:

(a) A certified copy of a certificate or diploma issued after four years of study either in a normal, manual training or high school of the first grade in this State, or in a legally constituted academy, seminary or institute of equal grade.

(b) A student's certificate of examination for admission to the freshman class of a reputable literary college, attested by the seal of the institution attended, or before a notary.

(c) A certificate from the State Superintendent of Public Instruction of New Jersey, who is authorized to determine whether the applicant's academic education is *fully equivalent* to either of the above requirements. Applicants applying for this form of certificate should present their credentials (academic, scientific, or commercial) in person, to the State Superintendent of Public Instruction, Trenton, N. J., at least two weeks prior to the State or county examinations for teachers, as given below.

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3. Medical Requirements.—Applicants must have received a diploma conferring the degree of doctor of medicine from some legally incorporated medical college (which in the opinion of this board was in good standing at the time of issuing said diploma) in the United States, or a diploma or license conferring the full right to practice all the branches of medicine and surgery in some foreign country, and have also studied medicine not less than four full years of at least nine months each, including four satisfactory courses of lectures of at least seven months each, in four different calendar years, in some legally incorporated American or foreign medical college or colleges, prior to the granting of said diploma or foreign license.

When applicants have taken lectures at more than one medical college, a certificate of attendance, attested by the seal of the college, must be presented from each institution, in addition to the affidavit on the blank from the college of graduation.

First Exemption.—Applicants for license who graduated prior to July 4th, 1903, and have been in continuous and reputable practice for at least five years since graduation, may be admitted to the examinations of this Board upon certified and satisfactory evidence of moral character, of three courses of medical lectures in different calendar years, and of a competent academic education according to the standard of that time, as determined in the case of non-graduates of academic institutions by the State Superintendent of Public Instruction; *provided, however*, that such substitution and exemption be specified in the license.

Second Exemption.—Applicants for license who graduated prior to July 4th, 1894, and have been in continuous and reputable practice since graduation, may be admitted to the examinations of this Board upon certified and satisfactory evidence of moral character, of two courses of medical lectures in different calendar years, and of a competent academic education according to the standard of that time, as determined in the case of non-gaduates of academic institutions by the State Superindendent of Public Instruction; *provided, further*, that such substitution and exemption be specified in the license.

4. Moral Requirements.—Applicants for examination must present a certificate of good moral character, signed by two physicians in good standing, one of whom must be a resident of New Jersey, recommending them as entirely worthy to be licensed to practice medicine and surgery in the State of New Jersey.

II. Application for Examination.

Applicants for examination should apply to the Secretary of this Board for a blank form of application, which must be filled out in accordance with the printed instructions on the blank, bear the seal of the medical institution from which the applicant was graduated, and be returned to the Secretary for approval and filing, with a certificate

of academic education and a certified check, signed by or payable to the order of the applicant, or a postal money order, for $25.00, the regular examination fee, *at least ten days before the date of the examination.*

In addition to the above requirements graduates of foreign institutions must obtain a certificate of academic education from the State Superintendent of Public Instruction of New Jersey and file the same with their applications, together with a certified translation of their medical diplomas, made by and under the seal of their respective consuls-general, showing that the applicant possesses *the full right* to practice medicine in all its branches in the country in which the diploma was issued, to which the applicant must make affidavit that he is the person named therein.

Each applicant will be required to file with his or her application for examination a recent photograph of himself or herself, on the reverse side of which the applicant must write his or her name before a notary or other legal official, who must certify over his seal to the identity of the photograph with the applicant and to the genuineness of the signature. No applicant will be admitted to the examination who has not complied with this rule.

If the application is approved, the applicant will be advised of the time and place of the examination and of the rules governing the same. Neither academic nor medical diplomas should be sent to the Secretary unless requested.

III. The Examinations.

1. Date and Place.—*The regular examinations of the Board are held in the Capitol at Trenton, on the Third Tuesday, Tuesday evening and Wednesday of June and October.*

2. Subjects of Examination.—All examinations shall be written in the English language, and shall be held in the following subjects, namely:

Section 1.—Materia Medica and Therapeutics.

Section 2.—Obstetrics and Gynecology.

Section 3.—Practice of Medicine, including physical diagnosis and diseases of the skin, nose and throat.

Section 4.—Surgery, including surgical anatomy and diseases of the eye, ear and genito-urinary organs.

Section 5.—Anatomy.

Section 6.—Physiology.

Section 7.—Chemistry.

Section 8.—Histology, Pathology and Bacteriology.

Section 9.—Hygiene and Medical Jurisprudence.

Candidates intending to practice homeopathy or eclecticism will be examined in materia medica and therapeutics by members of the Board of Examiners representing those schools.

Two hours are given to each section, in which fifteen questions are submitted, ten of which must be answered by the candidate.

Candidates are known by their official number, as stated below in Rule Ninth.

3.—Rules Governing the Examinations.

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Tenth.—Each candidate shall sign the following pledge before commencing the examination, viz.:

"I hereby pledge my word of honor, without mental reservation or evasion in any manner, that during my examination before this Board, which I am now about to commence, I will neither give to a fellow candidate nor receive from him, or from any other source whatever, any information relating to the subject under consideration; furthermore, I will write the number (given thereon opposite my name) upon all my examination papers as my official number."

The meeting of the Board to determine the averages of the candidates in the different sections will be held within two weeks after the examination; the votes of all examiners shall be *yes* or *no*, written with their signatures upon the backs of the examination papers of each candidate; and candidates will be informed of the results of the examination; candidates who have attained a total average of 90 per cent. or upwards will be placed on the Honor Roll.

In case of failure to pass the examination, the candidate may be re-examined at any regular examination within one year without the payment of an additional fee. Second or subsequent examinations include all branches.

IV.—State License.

1. Certificate of License.—Following the adjudication of each examination a certificate of license, signed by the examiners and attested by the seal of the Board, will be issued to each successful candidate, entitling him or her to practice medicine and surgery in the State of New Jersey, and the application forms, with examination questions, papers, averages, licentiate numbers, photographs and academic certificates will be recorded in the official register of the Board and filed permanently in the State Library at Trenton as *prima facie* evidence of all matters therein contained.

2. Certified Copy.—A certified copy will be issued with each certificate of license and must be filed with the clerk of the county in which the licentiate intends to practice. Licentiates removing from one county to another must file a certified copy of their license with the clerk of the county to which they remove; duplicate certified copies for registration or for indorsement by another State may be obtained from the Secretary of this Board by forwarding the original license with the regular fee of $2.00 or from the clerk of the county in which the certificate of the licentiate is registered.

3. Filing of License.—*Candidates for examination must not begin the practice of medicine in this State until they have received a certificate*

of license from this Board and have duly filed a certified copy of the same; otherwise liability to the penalities imposed by the statute will be incurred.

4. Temporary Licenses.—A temporary license may be granted to a resident and legally qualified physician of another State to take charge of the practice of a resident and legally qualified physician of this State, during the latter's absence from this State, temporarily, upon written request from the physician residing in this State, made on the blank form of this Board under affidavit and returned to the Secretary for filing with the regular fee of $2.00, when a license will be issued. This license covers a period of not less than two weeks nor more than four months. A temporary license will not be granted under any other conditions.

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VII.—Application of the Act to Regulate the Practice of Medicine and Surgery in New Jersey.

This act does not apply to the commissioned surgeons of the United States army, navy or marine hospital service while so commissioned, or to lawfully qualified physicians or surgeons residing in other States meeting registered physicians and surgeons of this State in consultation, or to any legally qualified physician or surgeon of another State taking charge of the practice of a legally qualified physician or surgeon of this State temporarily during the latter's absence therefrom and upon the written request to said Board therefor, or to any physician or surgeon of another State, and duly authorized under the laws thereof to practice medicine and surgery therein; *provided*, that such practitioner shall not open an office or a place for the practice of his profession within the borders of this State; or to anyone while actually serving as a member of the resident medical staff of any legally incorporated charitable or municipal hospital or asylum, or to any legally qualified and registered dentist exclusively engaged in practicing the art of dentistry, or to any person claiming the right to practice medicine and surgery in this State who has been practicing therein since before the fourth day of July, one thousand eight hundred and ninety; *provided*, said right or title was obtained upon a duly registered diploma, of which the holder and applicant was the lawful possessor, issued by a legally chartered medical institution which, in the opinion of said Board, was in good standing at the time said diploma was issued; or to any person resident of this State who has been continuously engaged in giving treatment by electricity herein during the past fourteen years; *provided*, that said person has graduated from a legally incorporated electro-therapeutic school in good standing, or to any legally licensed and registered pharmacist of this State actually engaged in the practice of his profession, but this exception shall not be extended so as to give said licensed pharmacist the right and authority to carry on the business of a dispensary,

unless said dispensary shall be in charge of a legally licensed and registered physician and surgeon of this State; or to any legally licensed and registered veterinary physician, surgeon or dentist of this State, engaged in the practice of veterinary medicine, surgery or dentistry in any of its branches; or to any professional nurse, masseur or electrician, operating in each particular case under the specific direction of a regularly licensed physician or surgeon; or to any person or persons giving aid, assistance or relief in emergency or accident cases pending the arrival of a regularly licensed physician and surgeon.

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Synopsis of Requirements for Indorsement of Medical Licenses Issued by Other States.

Medical licenses issued after examination by other States may be indorsed by New Jersey, in lieu of examination; *provided*, that the Standard of Requirements (academic, medical, moral and examining) of the State issuing the license is substantially the same as that of New Jersey; *and provided further*, that the candidate for indorsement complies with the conditions required of candidates examined by this State as follows:

I. Conditions of Indorsement.

1. Academic.—Candidates must present a certificate of academic education to attach to and file permanently with their application in one of the following forms:

(a) A certificate of graduation or a certified copy of diploma, issued after four years of study either in a normal, manual training or high school of the first grade in this State, or in a legally constituted academy, seminary, or institute of equal grade.

(b) A student's certificate of examination to admission to the freshman class of a reputable literary college, bearing the seal of the institution attended or duly attested before a notary.

(c) A certificate from the State Superintendent of Public Instruction of New Jersey, stating that the candidate's academic education is considered and accepted by him as fully equivalent to either of the above requirements, upon approval of credentials or thorough examination before the State or County Boards of Examiners for Teachers of this State, as stated [above].

2. Medical.—Candidates must have studied medicine not less than four full school years of at least nine months each, including four satisfactory courses of lectures of at least seven months each, in four different calendar years in a legally-incorporated American or foreign medical college or colleges, prior to receiving the degree of Doctor of Medicine in conformity with the requirements and exemptions more fully stated on pages 501 and 502.

3. Examining.—Candidates must have passed a State examination satisfactory to and approved by this Board, in substantially the

same medical branches, and under essentially the same rules and regulations as required by this Board for examination, and must have received a State license upon an average marking of at least seventy-five per cent.

4. Moral.—Candidates must present with their applications a certificate of moral character, either from an incorporated medical society signed by the president or secretary thereof over the seal of the society, or from two legally-qualified physicians, residents of the same locality as the candidate, duly attested by a notary.

5. Recommendation.—Candidates must present a letter from a registered reputable physician of New Jersey, recommending them for indorsement by this Board.

II. Application for Indorsement.

Application for indorsement must be made upon a blank form provided by this Board and obtained of its Secretary, and must be filled out in conformity with the above conditions; bear the seal of the medical institution from which the candidate was graduated, with the certificate of the dean or other executive officer, stating number and length of courses of lectures and date of graduation; bear a verbatim copy of the applicant's State medical license over the seal of the State Examining Board issuing the same, together with the affidavits of the President and Secretary thereof as to the date of examination, number of license, subjects examined and total averages attained, and must be returned to the Secretary of this Board for approval and filing, with the affidavit of the candidate and a certified check or postal money order for the regular fee of fifty dollars.

Graduates of foreign institutions must present a certificate of academic education from the State Superintendent of Public Instruction of New Jersey and file with their applications a certified translation of their academic and medical diplomas, made by and under the seal of their respective consuls-general, showing that the candidate possesses the *full right* to practice medicine in all its branches in the country in which the diploma was issued, to which the candidate must make affidavit that he is the person named therein.

The indorsement of a college diploma, or a foreign license, cannot be accepted in lieu of a State examination. Candidates must designate the State license to be indorsed, and the acceptance of an application for indorsement cannot be determined until the forms provided by this Board have been properly filled out and submitted for investigation and approval. Neither academic nor medical diplomas need be sent to the Secretary.

III. State Medical License.

I. Certificate of License.—If the application is approved, a certificate of license will be issued to the candidate signed by the members and attested by the seal of the State Board of Medical Examiners,

entitling the candidate to practice medicine or surgery in the State of New Jersey. All credentials will be recorded in the Register of the Board, and filed in the State Library at Trenton, as prima facie evidence of matters contained therein.

2. Certified Copy.—A certified copy of the license issued by this Board accompanies the State certificate and must be filed with the clerk of the county in which the candidate intends to practice. Candidates removing from one county to another must file a certified copy of their license with the clerk of the county to which they remove; duplicate certified copies may be obtained from the Secretary of this Board by forwarding the original license with the fee of $2.00, or from the clerk of the county in which the licentiate is registered.

Candidates for indorsement must not begin the practice of medicine in this State until they have received a certificate of license from this Board and have duly filed a copy of the same; otherwise, they are liable to the penalties of the statute governing the practice of medicine in this State.

NEW MEXICO

Laws of 1907. Chap. 34.

An Act to Regulate the Practice of Medicine in New Mexico and to Establish a Board of Health and Medical Examiners.

Be it enacted by the Legislative Assembly of the Territory of New Mexico:

Sec. 1.—That a board is hereby established to be called The New Mexico Board of Health and Medical Examiners, who shall be composed of seven reputable physicians of known ability, who are graduates of medical colleges in good standing, as hereinafter defined, and have been registered practitioners in, and bone fide residents of, the Territory of New Mexico for a period of five years next preceding the date of their appointment. . . . .

Sec. 2.— . . . . . Regular meetings of said board shall be held in the Capitol building on the second Mondays of January, April, July and October in each year, and there shall be not less than a two days' session at each meeting. Special meetings may be held at any time. . . . .

Sec. 3.—The said board shall, upon the production of evidence satisfactory to it, license without examination any reputable person who is a graduate of a medical college in good standing, as defined in this act, who has been in the active practice of his profession for two years next preceding the time of making application for such license and who personally appears before the board at a regular meeting. A medical college in good standing for the purpose of this act, is defined to be one which has a standard as high as that required by the Association of the American Medical Colleges, and which has ample clinical facilities. Said board, at its April meeting in each year, shall prepare and cause to be printed and distributed for the information of those interested a copy of this law, together with a list to be prepared by such board of colleges, in good standing, as defined by this act, and such board may revise such list at any regular meeting. The board shall not recognize any college which misrepresents its records, its teaching, its clinical facilities, or as to its students or graduates. No college of any foreign country shall be recognized, except to the same extent as such foreign country recognizes American Colleges, and when said foreign college is of good standing under the laws of New Mexico. No license shall be granted except by the board at a regular meeting, and every applicant for license shall appear in person before such board. Such board may recognize any honorary or emeritus degree conferred upon any foreigner by any

such college as fully and to the same extent as if the applicant were a regular graduate thereof.

SEC. 4.—Such board shall also license reputable graduates of colleges in good standing, as defined by this act, who have not been in the active practice of their profession for two years next preceding the time of making application for license; also graduates of any reputable college other than colleges in good standing, as defined by this act, who are of good moral and professional character and conduct, and have served an interneship in a good hospital, or who have taken a six months' post-graduate course in some institution having ample clinical facilities, or who have had three years or more of actual practice since graduation. *Provided*, That all applicants for licenses, of the classes referred to in this section, shall be examined on the following, and such other subjects as the board may from time to time prescribe: Anatomy and Histology, 10 questions; Chemistry, 5 questions; Etiology and Hygiene, 5 questions; Physiology, 5 questions; Materia Media, 10 questions; Therapeutics, 10 questions; Pathology and Bacteriology, 5 questions; Surgery, 10 questions; Physical Diagnosis, 10 questions; Obstetrics, 10 questions; Gynecology, 5 questions; Practice of Medicine, 10 questions; Medical Ethics and Jurisprudence, 5 questions. An average of seventy-five percent must be obtained at such examination by said applicant, and not less than fifty percent must be obtained on each subject; and board shall allow an applicant credit marks of five percent for five years' active practice: *Provided*, That the board may grant licenses without examination to those applicants who have been regular licensed physicians, in other states and territories, having qualifications and requirements equivalent to those required in New Mexico. The president and secretary of said board are hereby empowered to administer oaths to applicants and all witnesses and others appearing before said board in any application or proceeding provided for herein. And any person making a false oath or affidavit before such president or secretary in any such proceeding shall be deemed guilty of perjury and be subject to the punishment provided for that crime. Whenever any applicant for license shall have been examined as hereinbefore provided, and shall have failed to reach the required percentage in not more than two of any of the subjects hereinbefore designated, the board may in its discretion allow such applicant another examination on the subjects in which he shall have so failed at its next regular meeting, and may in is discretion issue him a temporary license authorizing him to practice medicine in the Territory of New Mexico until such next meeting and until his second examination shall have been passed upon and decided by such board.

SEC. 5.—Every person holding a certificate of said Board of Health shall have the same recorded in a book provided for that purpose in the office of the probate clerk of the county wherein the practitioner resides, within thirty days after said certificate is issued, and the date of the recording will be indorsed on said certificate. Said certificate, or copy of the registration, must be again recorded in any county to which the

practitioner may remove permanently. And the fact that no such certificate shall be found recorded in th county where any person practicing or offering to practice medicine shall be accepted by the court as prima facie evidence that no such certificate has been issued, and shall throw the burden of proving that he has a certificate upon the defendant in any suit or prosecution begun against him for the violation of the provisions of this act.

SEC. 6.—It is hereby made the duty of the board to refuse to license any person guilty of immoral, dishonorable or unprofessional conduct, and said board shall also revoke and annul any license which has been issued by said board, or any previous board, upon satisfactory proof being made to said board that the holder of said certificate or diploma has been guilty of immoral, dishonorable or unprofessional conduct.

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SEC. 7.—For the purposes of this act the words "practice of medicine" shall mean to open an office for such purpose or announce to the public or any individual in any way, a desire or willingness or readiness to treat the sick or afflicted, or to investigate or diagnose, or offer to investigate or diagnose any physical or mental ailment or disease of any person, or to suggest, recommend, prescribe or direct, for the use of any person, any drug, medicine, appliance or other agency, whether material or not material, for the cure, relief or palliation of any ailment or disease of the mind or body, or for the cure or relief of any wound, fracture or bodily injury or deformity, after having received, or with the intent of receiving therefore, either directly or indirectly, any bonus, gift or compensation. *Provided*, That nothing in this act shall be construed to prohibit gratuitous services in cases of emergency, or the domestic administration of family remedies, or women from practicing midwifery, and this act shall not apply to surgeons of the United States in the discharge of their official duties, and: *Provided*, further, that nothing in this act shall be construed so as to interfere with the practice of Osteopathy, Optometry, or Dentistry, as provided for by law.

SEC. 8.—Each applicant for a license to practice medicine in New Mexico shall pay the secretary of this board a fee of twenty-five dollars ($25) at the time of making his application.

SEC. 9.—Any person who shall practice medicine, or who shall attempt to practice, without first complying with the provisions of this law, and without being the holder of a license entitling him to practice medicine in New Mexico, shall be punished by a fine, not to exceed one hundred dollars ($100), or imprisonment in the county jail not to exceed ninety days, or by both such fine and imprisonment in the discretion of the court.

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NEW YORK

Law of 1907. Chapter 344.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

§1. *Definitions as used in this Act,—*

1. The education department means the education department in the state of New York, as provided for by chapter 40 of the laws of nineteen hundred and four.

2. University means university of the state of New York.

3. Regents means board of regents of the university of the state of New York.

4. Board means the board of medical examiners of the state of New York.

5. Medical examiner means a member of the board of medical examiners of the state of New York.

6. Medical school means any medical school, college, or department of a university, registered by the regents as maintaining a proper medical standard and as legally incorporated.

7. The practice of medicine is defined as follows: A person practicing medicine within the meaning of this act, except as hereinafter stated, who holds himself out as being able to diagnose, treat, operate, or prescribe for any human disease, pain, injury, deformity or physical condition, and who shall either offer or undertake, by any means or method, to diagnose, treat, operate, or prescribe for any human disease, pain, injury, deformity, or physical condition.

8. Physician means a practitioner of medicine.

§2. *Qualifications.*—No person shall practice medicine, unless registered and legally authorized prior to September first, eighteen hundred and ninety-one, or unless licensed by the regents and registered under article eight of chapter six hundred and sixty-one of the laws of eighteen hundre d and ninety-three and acts amendatory thereto, or unless licensed by the regents and registered as required by this act; nor shall any person practice under this act who has ever been convicted of a felony by any court, or whose authority to practice is suspended or revoked by the regents on recommendation of the state board. The conviction of a felony shall include the conviction of any offense which if committed within the state of New York would constitute a felony under the laws thereof.

§3. *The State Board of Medical Examiners.*—There shall be a state board of medical examiners of the nine members who shall be appointed by the regents and who shall hold office for three years from August first

of the year in which appointed. In constituting the first board, however, ...

§4. *Certificate of Appointment; Oath; Powers.*—. . . .

§5. *Expenses.*—. . . .

§6. *Officers; Meetings; Quorum; Committees.*—. . . .

§7. *Admission to Examination.*—The regents shall admit to examination any candidate who pays a fee of twenty-five dollars and submits evidence, verified by oath, and satisfactory to the regents, that he

1. Is more than twenty-one years of age.

2. Is of good moral character.

3. Had prior to beginning the second year of medical study, the general education required preliminary to receiving the degree of bachelor or doctor of medicine in this state.

4. Has studied medicine not less than four school years, including four satisfactory courses of at least seven months each, in four different calendar years in a medical school registered as maintaining at the time a standard satisfactory to the regents. New York medical schools and New York medical students shall not be discriminated against by the registration of any medical school out of the state whose minimum graduation is less than that fixed by statutes for New York Medical schools. The regents may, in their discretion, accept as the equivalent for any part of the third and fourth requirements, evidence of five or more years' reputable practice, provided that such substitution be specified in the license, and, as the equivalent of the first year of the fourth requirement, evidence of graduation from a registered college course, provided that such college course shall have included not less than the minimum requirements prescribed by the regents for such admission to advanced standing. The regents may also in their discretion admit conditionally to the examination in anatomy, physiology, hygiene, sanitation, and chemistry, applicants nineteen years of age certified as having studied medicine not less than two years, including two satisfactory courses of at least seven months each, in two different calendar years, in a medical school registered as maintaining at the same time a satisfactory standard, provided that such applicants meet the second and third requirements.

5. Has either received the degree of bachelor or doctor of medicine from some registered medical school, or a diploma or license conferring full right to practice medicine in some foreign country unless admitted conditionally to the examination as specified above, in which case all qualifications, including the full period of study, the medical degree and the final examinations in surgery, obstetrics, gynecology, pathology, including bacteriology, and diagnosis must be met. The degree of bachelor or doctor of medicine shall not be conferred in this state before the candidate has filed with the institution conferring it the certificate of the regents that before beginning the first annual medical course counted toward the degree, unless matriculated conditionally as hereinafter specified, he had either graduated from a registered college or satisfactorily

completed a full course in a registered academy or high school; or had a preliminary education considered and accepted by the regents as fully equivalent; or held a regents' medical student certificate; or passed regents' examinations securing sixty academic counts, or their full equivalent, before beginning the first annual medical course counted toward the degree, unless admitted conditionally as hereinafter specified. A medical school may matriculate conditionally a student deficient in not more than one year's academic work or fifteen counts of the preliminary education requirement, provided the name and deficiency of each student so matriculated be filed at the regents' office within three months after matriculation, and that the deficiency be made up before the student begins the second annual medical course counted toward the degree.

6. Where the applicant be for a license to practice osteopathy, the applicant shall produce evidence that he has studied osteopathy not less than three years including three satisfactory courses of not less than nine months each in three different calendar years in a college of osteopathy maintaining at the time a standard satisfactory to the regents. After nineteen hundred and ten the applicant for a license to practice under this act shall produce evidence that he has studied not less than four years including four satisfactory courses of not less than seven months each in four different calendar years in a college maintaining at the time a standard satisfactory to the regents.

§8. *Questions.*—The board shall submit to the regents, as required, lists of suitable questions for thorough examination in anatomy, physiology, hygiene, sanitation, chemistry, surgery, obstetrics, gynecology, pathology, including bacteriology, and diagnosis. From these lists the regents shall prepare question papers for all these subjects, which at any examination shall be the same for all the candidates, except that the examination may be divided as provided in section seven.

§9. *Examinations and Reports.*—Examinations for licenses shall be given in at least four convenient places in this state and at least four times annually, in accordance with the regents' rules, and shall be exclusively in writing and in English. Each examination shall be conducted by a regents' examiner who shall not be one of the medical examiners. . . . .

If a candidate fails on first examination, he may, after not less than six months' further study, have a second examination without fee. If the failure is from illness or other cause satisfactory to the regents they may waive the required six months' study.

§10. *Licenses.*—On receiving from the state board an official report that an applicant has successfully passed the examinations and is recommended for license, the regents shall issue to him a license to practice according to the qualifications of the applicant. Every license shall be issued by the university under seal and shall be signed by each acting medical examiner and by the officer of the university, who approved the credential which admitted the candidate to examination, and shall state

that the licensee has given satisfactory evidence of fitness as to age, character, preliminary and medical education and all other matters required by law, and that after full examination he has been found properly qualified to practice. Applicants examined and licensed by other state examining boards registered by the regents as maintaining standards not lower than those provided by this article and applicants who matriculated in a New York state medical school before June fifth, eighteen hundred and ninety, and who received the degree of doctor of medicine from a registered medical school before August first, eighteen hundred and ninety-five, may without further examination, on payment of twenty-five dollars to the regents and on submitting such evidence as they may require, receive from them an indorsement of their licenses or diplomas conferring all rights and privileges of a regents' license issued after examination. The commissioner of education may in its discretion on the approval of the board of regents indorse a license or diploma of a physician from another state, provided the applicant has met all the preliminary and professional qualifications required for earning a license on examination in this state, has been in reputable practice for a period of ten years, and has reached a position of conceded eminence and authority in his profession. If any person, whose registration is not legal because of some error, misunderstanding or unintentional ommission, shall submit satisfactory proof that he had all requirements prescribed by law at the time of his imperfect registration and was entitled to be legally registered, he may on unanimous recommendation of the state board of medical examiners receive from the regents under seal a certificate of the facts which may be registered by any county clerk and shall make valid the previous imperfect registration. Before any license is issued it shall be numbered and recorded in a book kept in the regents' office, and its number shall be noted in the license; and a photograph of the licensee filed with the records. This record shall be open to public inspection, and in all legal precedings shall have the same weight as evidence that is given to a record of conveyance of land.

§11. *Registry; Revocation of License; Annulment of Registry.*—Every license to practice medicine shall, before the licensee begins to practice thereunder, be registered in a book kept in the clerk's office of the county where such practice is to be carried on, with name, residence, place and date of birth, and source, number and date of his license to practice. . . . . .

§12. *Registry in Another County.*—A practicing physician having registered a lawful authority to practice medicine in one county, and removing such practice or part thereof to another county, or regularly engaging in practice or opening an office in another county shall show or send by registered mail to the clerk of such other county, his certificate of registration. . . . .

§13. *Certificate Presumptive Evidence; Unauthorized Registration and License Prohibited.* . . . .

§14. *Construction of this Article.*—This article shall not be construed

to affect commissioned medical officers serving in the United States army, navy or marine hopital service, while so commissioned; or any one while actually serving without salary or professional fees on the resident medical staff of any legally incorporated hospital; or any legally registered dentist exclusively engaged in practicing dentistry; or any person or manufacturer who mechanically fits or sells lenses, artificial eyes, films, or other apparatus or appliances, or is engaged in the mechanical examination of the eyes, for the purpose of constructing or adjusting spectacles, eye glasses and lenses; or any lawfully qualified physician in other states or countries meeting legally registered physicians in this state in consultation; or any physician residing on a border of a neighboring state and duly licensed under the laws thereof to practice medicine therein, whose practice extends into this state, and who does not open an office or appoint a place to meet patients or receive calls within this state; or any physician duly registered in one county called to attend isolated cases in another county, but not residing or habitually practicing therein; or the furnishing of medical assistance in cases of emergency; or the domestic administration of family remedies; or the practice of chiropody; or the practice of the religious tenets of any church. This act shall be construed to repeat all articles or parts of articles authorizing confernment of any degree in medicine causa honoris or ad eundem or otherwise than on students duly grauduated after satisfactory completion of a preliminary medical course not less than required by this article as a condition of license. It is further provided that any person who shall be actively engaged in the practice of osteopathy in the state of New York on the date of the passage of this Act, and who shall present to the board of regents satisfactory evidence that he is a graduate in good standing of a regularly conducted school or college of osteopathy within the United States which at the time of his or her graduation required a course of study of two years or longer, including the subjects of anatomy, physiology, pathology, hygiene, chemistry, obstetrics, diagnosis and the theory and practice of osteopathy, with actual attendance of not less than twenty months, which facts shall be shown by his or her diploma and affidavit, shall upon application and payment of ten dollars be granted, without examination, a license to practice osteopathy, provided application for such license be made within six months after the passage of this act. A license to practice osteopathy shall not permit the holder thereof to administer drugs or perform surgery with the use of instruments. Licenses to practice osteopathy shall be registered in accordance with the provisions of this act, and the word osteopath be included in such registration; and such license shall entitle the holder thereof to the use of the degree D. O., or doctor of osteopathy.

NORTH CAROLINA

Extracts from the Laws Regulating the Practice of Medicine in North Carolina. From the Code of 1905.

Sec. 4492. *Board of Examiners.*—In order to the proper regulation of the practice of medicine and surgery, there shall be established a board of regularly graduated physicians, to be known by the title of The Board of Medical Examiners of the State of North Carolina, which shall consist of seven regular graduated physicians.

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Sec. 4498. *Applicants for License Examined.*—It shall be the duty of the said board to examine all applicants who shall exhibit a diploma, or furnish satisfactory proof of graduation, from a medical college in good standing, requiring an attendance of not less than three years and supplying such facilities for clinical instruction as shall meet the approval of said board, for license to practice medicine or surgery, or any of the branches thereof, on the following branches of medical science: Anatomy, physiology, surgery, pathology, medical hygiene, chemistry, pharmacy, materia medica, therapeutics, obstetrics and the practice of medicine, and if on such examination they be found competent, to grant to each applicant a license or diploma, authorizing him to practice medicine and surgery, or any of the branches thereof. Five members of the board shall constitute a quorum and four of those present shall be agreed as to the qualifications of the applicant: *Provided,* that the requirement of three years' attendance at school shall not apply to those graduating prior to January 1, 1900; *Provided further* that license or other satisfactory evidence of standing as a legal practitioner in another state shall be accepted in lieu of a diploma and entitle to examination.

Laws 1907. Chap. 890.

(a) That the Board of Medical Examiners shall in their discretion issue a license to any applicant to practice medicine and surgery in this State without examination if said applicant exhibits a diploma or satisfactory proof of graduation from a medical college in good standing, requiring an attendance of not less than three years and a license issued to him to practice medicine and surgery by the Board of Medical Examiners of another State:

Sec. 4499. *Temporary License.*—To prevent delay and inconvenience, two members of the board of medical examiners may grant a

temporary license to any applicant who shall comply with the requirements as to graduation, prescribed in section, and make report thereof to the next regular meeting of the board: *Provided*, such temporary license shall not continue in force longer than the next regular meeting of the board, and such temporary license shall in no case be granted after the applicant has been refused a license by the board of medical examiners.

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SEC. 4501. *License Fee.*—The board shall have power to demand of every applicant thus licensed the sum of ten dollars before issuing a license or diploma, and the sum of five dollars for each temporary license, to be paid to the secretary of the board.

SEC. 4502. *Not to Practice Without License.*—No person shall practice medicine or surgery, nor any of the branches thereof, nor in any case prescribe for the cure of diseases for fee or reward, unless he shall have been first licensed and registered so to do in the manner provided in this chapter, and if any person shall practice medicine or surgery without being duly licensed and registered as provided in this chapter he shall not be allowed to maintain any action to collect any fee for such services.

SEC. 4503. *Board may Rescind License.*—The said board shall have the power to rescind any license granted by them when upon satisfactory proof it shall appear that any physician thus licensed has been guilty of grossly immoral conduct.

SEC. 4504. *Must be Registered before Practicing.*—Any person desiring to begin or engage in the practice of medicine or surgery shall personally appear before the clerk of the superior court of the county in which he resides or practices, for registration as a physician or surgeon. The person so applying shall produce and exhibit before the clerk of the superior court a license obtained from the board of medical examiners of the state, or a diploma issued by a regular medical college prior to the seventh day of March, one thousand eight hundred and eighty-five or make oath that he was practicing medicine or surgery in this state prior to said seventh day of March, one thousand eight hundred and eighty-five, and upon such exhibit or oath being made as aforesaid, the clerk shall register the date of registration with the name and residence of such applicant in a book to be kept for this purpose in his office, marked "Register of Physicians and Surgeons," and shall issue to him a certificate of such registration under the seal of the superior court of the county upon the form furnished him, as hereinafter provided, for which the clerk shall be entitled to collect from said applicant a fee of twenty-five cents. The person obtaining said certificate shall be entitled to practice medicine or surgery or both, in the county where the same was obtained, and in any other couny in this state; but if he shall remove his residence to another county he shall exhibit the said certificate to the clerk of such other county and be registered, which regis-

tration shall be made by said clerk without fee or charge, *Provided*, that anyone having obtained a temporary license as provided in section four thousand four hundred and ninety-nine, shall not be entitled to register, but may practice during the time such license shall remain in force.

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NORTH DAKOTA

EXTRACTS FROM THE LAWS OF NORTH DAKOTA RELATING TO THE STATE BOARD OF MEDICAL EXAMINERS. CODE OF 1905.

SECTION 294.—*Board of Medical Examiners. How Appointed. Qualifications.*—The governor shall appoint a state board of medical examiners consisting of nine members, of whom eight shall be practicing physicians, graduates of reputable medical colleges, who shall hold their office for three years after such appointment and until their successors are appointed and qualified. Two members of such board shall be homeopathic physicians and one a lawyer.

SEC. 295.—*Officers. Meeting for Examinations. Record of Licenses.*—Such board shall elect a president and treasurer, and shall have a seal. The president and secretary shall have power to administer oaths. The board shall hold meetings for examinations at each place as it may designate on the first Tuesday in January, April, July and October of each year, and such special meetings as it may from time to time appoint. The board shall keep a record of all its proceedings, and also a register of applicants for license together with their ages, time spent in the study of medicine and the name and location of all institutions granting to such applicants degrees or certificates of attendance on lectures in medicine and surgery. Such register shall also show whether the applicant was rejected or licensed under this article. Said books and register shall be prima facie evidence of all matters therein recorded.

SEC. 296.—*Examinations, How Conducted. Licenses, When Revokable.*—All persons before commencing the practice of medicine, surgery or obstetrics in this state shall apply to the board for a license so to do, and such applicant shall submit to an examination in the following subjects: Anatomy, physiology, chemistry, pathology, therapeutics, diseases of women and children, nervous diseases, diseases of the eye and ear, medical jurisprudence and such other subjects as the board deems advisable, and present evidence of having graduated from a reputable medical college, and attended three courses of lectures of at least six months each; provided, however, that after the year 1904, applicants must present evidence of having graduated from a reputable medical college and attended four courses of lectures of at least eight months each; the board shall cause such examination to be practical and scientific and sufficient to test the candidate's fitness to practice medicine, surgery and obstetrics; provided however, that the examination of any applicant in therapeutics shall be conducted by the member or members of said board who represent the system of medicine of which such applicant has been a student. If there be no representative of

the school or system of which the applicant has been a student, the examination in therapeutics shall be conducted by an examiner appointed for that purpose by the governor of North Dakota, but all other examinations other, than that in therapeutics shall be conducted heretofore provided by this section. If such applicant passes the prescribed examination the board shall grant him a license to practice medicine, surgery, and obstetrics in this state, which license shall be signed by the president and secretary of the board and attested by the seal thereof. The fee for such examination shall be twenty dollars to be applied by the board toward paying the expenses thereof. The board in its discretion, may grant license for the same fee without examination to applicants examined and licensed by other state examining boards maintaining standards not lower than those provided for in this article. The board may revoke or refuse a license for dishonorable or immoral conduct, chronic or persistent inebriety or for the practice of criminal abortion. In complaints for violating the provisions of this section the accused shall be furnished with a copy of the complaint and given a hearing before the board in person or by attorney.

Sec. 297.—*License to be Recorded.*—The person receiving a license shall file the same for record in the office of the register of deeds of the county wherein he resides, and the register of deeds shall record the same in like manner as other instruments required to be recorded.

Sec. 298.—*Who Exempt from Provisions of this Article.*—This article shall not apply to surgeons of the United States army or navy, physicians or surgeons in actual consultation from other states or territories or actual medical students practicing medicine under the direct supervision of a preceptor.

Sec. 299.—*Penalty for Practicing Without License.*—. . . .

OHIO

Laws 1908. House Bill 1268. State Medical Board.

Sec. 19.—The governor, with the advice and consent of the Senate, shall appoint a state medical board consisting of seven members, who shall be physicians in good standing in their profession. One member shall be appointed each year and shall serve for a term of seven years. Schools of practice shall be given representation on the board as nearly as possible in proportions to their numerical strength in the state, but no school shall have a majority of the board.

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Sec. 24.—The state medical board shall meet in Columbus on the first Tuesday of January, April, July and October of each year, and at such other times and places as the board may direct. Five members of the board shall constitute a quorum. The board shall have a seal and shall prescribe rules for its government.

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Sec. 26.—Each person who desires to practice medicine or surgery shall file with the secretary of the state medical board a written application, under oath, on a form prescribed by the board, and furnish satisfactory proof that he is more than twenty-one years of age and of good moral character.

Sec. 27.—The state medical board shall appoint an entrance examiner who shall not be directly or indirectly connected with a medical college and who shall determine the sufficiency of the preliminary education of applicants for admission to the examination. The following preliminary educational credentials shall be sufficient:

A diploma from a reputable college granting the degree of A. B., B. S., or equivalent degree;

A diploma from a legally constituted normal school, high school, or seminary, issued after four years of study;

A teacher's permanent or life certificate;

A student's certificate of examination for admission to the freshman class of a reputable literary or scientific college.

In the absence of the foregoing qualifications. . . . .

The applicant must also produce a certificate issued by the entrance examiner and a diploma from a legally chartered medical institution in the United States, in good standing, as defined by the board, at the time the diploma was issued, or a diploma or license approved by the board which conferred the full right to practice all branches of medicine or surgery in a foreign country.

SEC. 28.—At the time of his application the applicant shall present such diploma or license, with his affidavit that he is the person named therein and is the lawful possessor thereof, stating his age, residence, the college or colleges at which he obtained his medical education, the time spent in each, the time spent in the study of medicine, and such other facts as the state medical board requires. If engaged in the practice of medicine or surgery, the affidavit shall state the period during which and the place where he has been so engaged.

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SEC. 30.—The examination of applicants for certificates to practice medicine or surgery shall be conducted in the cities of Cincinnati, Cleveland, Columbus, and Toledo, under rules prescribed by the state medical board. Each applicant shall be examined in anatomy, physiology, pathology, chemistry, materia medica and therapeutics, the principles and practice of medicine, diagnosis, surgery, obstetrics and such other subjects as the board requires. The applicant shall be examined in materia medica and therapeutics and principles and practice of medicine of the school of medicine in which he desires to practice, by the member or members of the board representing such school.

SEC. 31.—If the applicant pass such examination, and has paid the fee required by law, the state medical board shall issue its certificate to that effect, signed by its president and secretary, and attested by its seal. Such certificate, when deposited with the probate judge as required by law, shall be conclusive evidence that the person to whom it is issued is entitled to practice medicine or sugery in this state. An affirmative vote of not less than five members of the board is required for the issuance of a certificate.

SEC. 32.—The state medical board may refuse to grant a certificate to a person guilty of fraud in passing the examination, or at any time guilty of felony of gross immorality, or addicted to liquor or drug habit to such a degree as to render him unfit to practice medicine or surgery. Upon notice and hearing, the board, by a vote of not less than five members, may revoke a certificate for like cause or causes.

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SEC. 34.—Each applicant for a certificate to practice medicine or surgery in this state shall pay a fee of twenty-five dollars for an examination. On failure to pass such examination the fee shall not be returned to the applicant, but within a year after such failure he may present himself and be again examined without the payment of an additional fee. All fees for examination shall be paid in advance to the treasurer of the board and by him paid into the state treasury to the credit of a fund for the use of the state medical board.

SEC. 35.—Each person who receives a certificate to practice medicine or surgery, before beginning practice, must deposit his certificate with the probate judge of the county in which he resides. The probate judge

shall record it in a book kept for that purpose and indorse on the margin of the record and on the certificate the time when he received it for record, and make an index to all certificates by him recorded. The probate judge shall also note the revocation of a certificate, or the death or change of location of the owner of a certificate in the margin of the record. If the owner of a certificate changes his place of residence, he must have such certificate recorded by the probate judge of the county into which he removes.

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SEC. 39.—The state medical board may dispense with the examination of a physician or surgeon, duly authorized to practice medicine or surgery in another state, a territory or the District of Columbia, who wishes to remove from such state, territory and district and reside and practice his profession in this state, upon his complying with the following conditions:

Such physician or surgeon shall make an application on a form prescribed by the board, pay a fee equal to that which such state, territory or district would require a physician or surgeon of this state removing from this state and residing and practicing his profession in such state, territory or district, and present a certificate or license issued by the medical board thereof; provided the laws of such state, territory or district require of physicians and surgeons practicing therein qualifications of a grade equal to those required of physicians and surgeons practicing in Ohio, and equal rights are accorded by such state, territory or district to physicians and surgeons of Ohio holding a certificate from the State medical board who desire to remove to, reside and practice their profession in such state, territory or district.

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SEC. 44.—Nothing in this act shall prohibit service in cases of emergency, or domestic administration of family remedies. This act shall not apply to a commissioned medical officer of the United States army-navy or marine hospital service in the discharge of his official duties, or to a regularly qualified dentist when engaged exclusively in the practice of dentistry, or to a physician or surgeon residing in another state or territory who is a legal practitioner in medicine or surgery therein, when in consultation with a regular practitioner of this state; nor shall this act apply to a physician or surgeon residing on the border of a neighboring state and duly authorized under the laws thereof to practice medicine and surgery therein, whose practice extends within the limits of this state; provided equal rights and privileges are accorded by such neighboring state to the physicians and surgeons of Ohio residing on the border of this state contiguous to such neighboring state. Such practitioner shall not open an office or appoint a place to see patients or receive calls within the limits of this state.

OKLAHOMA

Laws 1907–08. Practice of Medicine.

Be it enacted by the People of the State of Oklahoma:

Sec. 1.—A State Board of Medical Examiners is hereby established, to consist of nine members, learned in medicine, legal and active practitioners in the state of Oklahoma, who shall have resided and practiced medicine in the State under a diploma from a legal and reputable college of medicine of the school to which said practitioner shall belong, for more than three years prior to their appointment, and no one of such schools shall have a majority on said Board.

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Sec. 5.—Said Board shall hold regular meeting every three months in some convenient city or town in this State, for the examination of certificates. . . . .

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Sec. 7.—Every person before practicing medicine and surgery, or any of the departments of medicine and surgery in this State, must have the credentials herein provided for. In order to procure such credentials he must procure satisfactory evidence of good moral character, and a diploma issued by some legally chartered medical school or college, the requirements of such medical school or college shall have been, at the time of granting such diploma, in no particular less than those prescribed by the American Association of Medical Colleges, or the Southern Association of Medical Colleges, in that year in which the said diploma was granted. Or he must show satisfactory evidence of having possessed such diploma or license from some legally constituted institution which grants medical and surgical licenses only on actual examination, or satisfactory evidence of having possessed such license or diploma. He must accompany such diploma or license with an affidavit showing that he is the person therein named, and that the diploma or license was procured in the regular course without fraud or misrepresentation of any kind, such affidavit to be taken before any person authorized to administer oaths. The same shall be attested under the hand and seal of such officer, if he have a seal. In addition to such affidavit, the Board shall hear such information as in its discretion it may deem proper as to any of the matters embraced in said affidavits. If it should appear from the evidence that said affidavit is untrue in any particular, or if it should appear that the applicant is not of good moral character, the application must be rejected, Provided, that

osteopaths shall be subject to the above regulations, with the exception that instead of the diploma hereinbefore mentioned, they shall be required to file a diploma from a legally chartered college of osteopathy in good repute as such, having a course of instruction of at least twenty months, requiring actual attendance thereon, and after 1907, of three years of nine months each. In addition to the requirements above set out, each applicant for a certificate, upon the payment of a fee of $15.00 to the secretary of the State Board of Health, must be personally examined by said Board as to his qualifications to practice medicine and surgery. The examination must be conducted in the English language, and shall be in whole or in part in writing, and shall be on the following branches, to wit, which branches shall be considered fundamental:

Anatomy, Histology, Physiology, Chemistry, Physical Diagnosis, Bacteriology, Pathology, Medical Jurisprudence, Toxicology, Surgery, Gynecology and Obstetrics, the branches peculiar to the teachings of the school attended by the applicant, and such other additional subjects made necessary by the advance in medical education as the Board may designate or deem advisable to test the scientific and practical knowledge of the applicant; provided, that the applicant shall be examined in theory and practice, materia medica and therapeutics by those members of the Board of Examiners who represent the school of practice to which the applicant professes to belong; and be it further provided, that those legally qualified to practice medicine only in that school known as osteopathy shall not be permitted to administer medicines internally in the treatment of diseases except in the use of anesthetics in the practice of surgery and obstetrics, and in cases of emergency. The credentials of applicants, which shall sworn to by the applicants, relating to their general reputation, their preliminary education and the course of studies that they have pursued; the degrees they have received; the number of years they have been engaged in the lawful practice of medicine; their experience in general hospitals; the medical department of the army and navy and public health and marine and hospital service, licenses granted to them by other states and countries, and their experience as teachers of medicine. All these shall be given consideration by the Board in conducting its examinations.

Provided, that nothing herein contained shall be so construed as to prevent midwives from practicing, in cases of emergency.

Providid further, that those who use only herbs and roots and treat diseases without compensation shall not be required to register.

Provided however, that all physicians who have lawfully registered since Statehood, shall not be required to re-register under this Act.

SEC. 8.—The said Board may, at its discretion, accept and register upon payment of the registration fee, without examination of the applicant, any certificate which shall have been issued to him, or he, by the State Board of Examiners of other States, territories or the District of Columbia; *Provided*, however, that the legal department

of such Medical Examining Board shall appoint, at the time of issuing such certificate, in no degree or particular less than those of Oklahoma at the time when such certificate shall be presented for registration to the Board created by this Act;

and *provided further*, that the provisions provided in this Act shall be held to apply only to such medical examining boards as accept and register to certificates granted by this Board without examination by them of the one holding such certificate. Such applicant, upon making application, shall pay to the secretary of the Board a fee of $25.00, which shall be paid into the treasury of said Board by its secretary.

Sec. 9.—The said Board of Medical Examiners shall conduct and grade all examinations, and all applicants who shall make an average grade of seventy percent and a minimum in any one branch of fifty percent, and who shall have complied with the conditions specified in Section 7 of this act, shall receive the certificate entitling such applicant to practice medicine in this State, subject to the performance by the said applicant of the heretofore preliminary conditions in this Act required. . . . . In case of failure to secure the percentage required for a passing grade, the applicant may take another examination within twelve months without extra cost. Temporary permits may be granted and shall be effective until the next meeting of the Board, unless sooner revoked for cause; Provided, that the applicant shows good faith by payment to the secretary of the State Board of Health, the regular examination fee and delivering to the Board such credentials and other evidence of intentions to become a bona fide resident of the State, as the Board may require.

Sec. 10.—When any applicant has shown himself to be possessed of the qualifications herein required and has successfully passed the examination, a certificate must be issued to him by said Board, authorizing him to practice medicine and surgery in this State. Said certificate shall be signed by each member of the Board and sealed with the seal of said Board; provided, however, that all physicians and surgeons who were legally licensed and practicing in Oklahoma Territory and The Indian Territory on the 16th day of November, 1907, shall be required to register with the said Board, but shall be exempt from examination, except as to their credentials, and shall be entitled to re-registration with the said Board, and certificate of registration free of cost; *Provided*, however, that said physician and surgeon desiring registration shall make an application therefor within ninety days after this Act becomes operative, such physician and surgeon failing to make any such application within the said ninety days shall be considered an illegal practitioner, and shall be dealt with as herein provided, for the violation of this Act.

Sec. 11.—Every person holding a certificate authorizing him to practice medicine and surgery in this State, must have it recorded in the Office of the county clerk, as herein provided. Every such person, on the change of residence, must have his certificate recorded in like

manner in the county to which he shall have changed his residence, and said certificate shall be displayed in his office as an evidence of having complied with the law. The absence of such record shall be prima facie evidence of the want of possession of such certificate, and every such person holding such certificate, who shall practice medicine and surgery, or attempt to practice medicine and surgery, without having first recorded same with the county clerk, as herein provided, shall be deemed guilty of a misdemeanor.

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SEC. 13.—Said Board must refuse a certificate to any applicant guilty of unprofessional conduct, but before such refusal, the applicant must be cited by citation signed by the secretary of the Board and sealed with its seal. . . . .

Whenever any holder of a certificate, issued as herein provided, shall be guilty of unprofessional conduct as defined by this Act, and such unprofessional conduct is brought to the attention of the Board granting said certificate, in the manner herein pointed out, it shall be their duty to, and they must at once revoke the same, and the holder of such certificate shall not thereafter be permitted to practice medicine and surgery or in any other departments of medicine and surgery in this State. But no such revocation shall be made unless such holder is cited to appear and the same proceedings are had, as is hereinbefore provided in this section, in case of refusal to issue certificates. The accused party, at the time he presents his answer for filing, shall deposit with the secretary his certificate, and unless he does so, the secretary must not file his answer, and default may be thereon entered against him, and his certificate revoked if the charges on their face be deemed sufficient by the Board. From the time of the revocation of certificates the holder shall be disqualified from practicing medicine in this State.

The words "unprofessional conduct," as used in this Act, are hereby declared to mean. . . . .

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SEC. 18.—The following persons shall be deemed as practicing medicine and surgery within the meaning of this Act:

First, those who prescribe or administer any drug or medicine now or hereafter included in materia medica in the treatment of disease, injury or deformity of human beings.

Second.—Those who practice major or minor surgery in the treatment of disease, injury or deformity of human beings, except dealers in surgical, dental or optical appliances.

The doing of any of the acts in this section mentioned shall be taken as prima facie evidence of an intent on the part of the person doing any of the said acts to represent himself as engaged in the practice of medicine or surgery, or both. But nothing in this Act shall be so construed as to prohibit the service in the case of emergency or the

domestic administration of family remedies; nor shall this Act apply to any commissioned medical officer in the United States army, navy or marine hospital service in the discharge of his official duties, nor to any legally qualified dentist when engaged exclusively in the practice of dentistry, nor to any physician or surgeon from another state or territory, when in actual consultation with a legal practitioner of this State, if such physician or surgeon is, at the time of said consultation, a legal practitioner of medicine and surgery in the state or territory in which he resides, nor to any physician or surgeon residing on the border of a neighboring state and duly authorized under the laws thereof to practice medicine and surgery therein, whose practice extends within the limits of this State, providing that such physician or surgeon shall not open an office or a place to meet patients or receive calls within the limits of this State.

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OREGON

CODES AND STATUTES 1901. CHAPTER 4. REGULATING THE PRACTICE OF MEDICINE AND SURGERY.

3795. *Oath of Members, Officers and Meetings of Board, and Record of Proceedings.*—. . . .

Said medical examining board shall hold meetings for examination on the first Tuesday in January and July of each year. Said meetings shall be held in Portland, Oregon: Provided, that the board may call special meetings when in the opinion of a majority of said board such special meetings are necessary. . . .

3796. *License to Practice Medicine, Application and Examination for.*—See Law 1903, below.

3797. *"Unprofessional" and "Dishonorable Conduct," Meaning of.*—The words "unprofessional" or dishonorable conduct," as used in the preceding section, are hereby declared to mean: *first*, the procuring or aiding or abetting in procuring a criminal abortion, *second*, the employing of what are commonly known as "cappers" or "steerers," *third*, the obtaining of any fee on the assurance that a manifestly incurable disease can be permanently cured; *fourth*, the wilfull betraying of a professional secret; *fifth*, all advertising of medical business in which untruthful and improbable statements are made; *sixth*, all advertising of any medicines, or of any means whereby the monthly periods of women can be regulated, or the menses re-established, if suppressed; *seventh*, conviction of any offense involving moral turpitude; *eighth*, habitual intemperance.

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3800. *Filing and Record of License, Removal of Licensee.*—The person receiving said license shall file the same, or a copy thereof, with the county clerk in and for the county where he resides, and said county clerk shall file said certificate, or copy thereof, and enter a memorandum thereof, giving the date of said license and the name of the person to whom the same is issued, and the date of such filing, in a book to be provided and kept for that purpose, and said county clerk shall each year furnish to the secretary of said board a list of all certificates on file in his office, and upon notice to him of the change of location or death of a person so licensed, or of the revocation of the license granted to such person, said county clerk shall enter at the appropriate place in the record so kept by him a memorandum of said facts, so that the records kept by said clerk shall correspond with the records of the board as kept by the secretary thereof. In case a person so licensed shall remove

into another county of this state, he or she shall procure from the county clerk a certified copy of said license and file the same with the county clerk in the county to which he or she shall remove. Said county clerk shall file and enter the same with like effect as if the same was the original license.

3801. *Penalty for Practicing without License.*—. . . .

Any person shall be regarded as practicing within the meaning of this act who shall append the letters "M. D." or "M. B." to his or her name, or, for a fee, prescribe, direct or recommend for the use of any person, any drug or medicine or agency for the treatment, care, or relief of any wound, fracture or bodily injury infirmity, or disease: Provided however, the act shall not apply to dentists in the practice of their dental profession. . . . .

Laws of 1903.

An Act.

Be it enacted by the Legislative Assembly of the State of Oregon; and, also, Be it enacted by the People of the State of Oregon:

Sec. 1.—That section 3796 of the Codes and Statutes of Oregon, as compiled and annotated by Chas. B. Bellinger and Wm. W. Cotton, be and the same is hereby amended so as to read as follows:

3796.—Every person, except as hereinafter provided, desiring to practice medicine and surgery, or either of them, in any of their or its branches in this state, shall make a written application to said board for a license so to do, and application shall be supported and accompanied by an affidavit of such applicant, setting forth the actual time spent by such applicant in the study of medicine and surgery, and when, whether such study was in an institution of learning, and if so, the name and location thereof, and if not in such an institution, where and under whose tutorship such study was prosecuted, the time said applicant shall have been engaged in the actual practice, if at all, of medicine and surgery, or either of them, and where the applicant was located during the time of such practice, and the age of the applicant at the time of making application; such application and affidavit to be filed and preserved of record in the office of the secretary of said board. Such applicant, at the time and place designated by said board, or at the regular meeting of said board, shall submit, to an examination in the following branches, to wit: Anatomy, physiology, chemistry, materia medica, therapeutics, practice of medicine, surgery, obstetrics, diseases of women, medical jurisprudence, and such other branches as the board may deem advisable. Said board shall cause such examination to be both scientific and practical, and of sufficient severity to test the candidate's fitness to practice medicine and surgery, which examination shall be by written or printed, or partly written and partly printed, questions and answers, and the same shall be filed and preserved of record in the office of the secretary of said board. After examination, if the same is satisfactory, said board shall grant a license to such applicant to practice medicine and sur-

gery in the State of Oregon; which said license can only be granted by the consent of not less than four members of said board, except as hereinafter provided, and which said license shall be signed by the president and secretary of said board, and attested by the seal thereof. The fee for such examination shall be ten ($10) dollars, and shall be paid by the applicant to the treasurer of said board toward defraying the expenses thereof; and such board may refuse or revoke a license for unprofessional or dishonorable conduct, subject, however, to the right of such applicant to appeal from the decision of said board refusing or revoking such license, as hereinafter provided: *Provided*, that all persons who have been regularly licensed under heretofore existing laws of this state, and having complied with the provisions thereof, shall be taken and considered as licensed physicians under this act, and the secretary of the board herein provided for, shall enter the names of such persons upon the register kept by him, as licensed physicians and surgeons, upon the written application of such persons, accompanied with such license heretofore regularly issued. *Provided, further*, that in all cases where an applicant for a license under this act shall produce and exhibit to the examining board a certificate from the board of medical examiners appointed under the laws of any state of the United States, which state recognizes licenses from this state, certifying to the fact that the person presenting such certificate is duly and well qualified to practice medicine and surgery in the state issuing such certificate, and that said board issuing said certificate has subjected the applicant to a thorough examination to ascertain this fact, he or she may, at the discretion of the examining board, upon paying the fee herein prescribed, and otherwise complying with all the requirements of this act, receive from the examining board, provided for in this act, a license as if the examination of said applicant was held in this state, and upon filing such license with the county clerk, as herein provided, he or she shall be a legally qualified practitioner of medicine and surgery in this state, subject to all the provisions of this act as to the revocation of said license as herein provided.

PENNSYLVANIA

An Act to establish a Medical Council and three State Boards of Medical Examiners, to define the powers and duties of said Medical Council and said State Boards of Medical Examiners, to provide for the examination and licensing of practitioners of medicine and surgery, to further regulate the practice of medicine and surgery, and to make an appropriation for the Medical Council.

Whereas, The safety of the public is endangered by incompetent physicians and surgeons, and due regard for public health and the preservation of human life demands that none but competent and properly qualified physicians and surgeons shall be allowed to practice their profession;

SECTION 1.—Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania in General Assembly met, and it is hereby enacted by the authority of the same: That there shall be established a Medical Council of Pennsylvania, consisting of the Lieutenant Governor, the Attorney General, the Secretary of Internal Affairs, the Superintendent of Public Instruction and the President of the State Board of Health and Vital Statistics, and the Presidents of the three State Boards of Medical Examiners provided for in this act.

SECTION 2.—The said council shall be known by the name and style of the Medical Council of Pennsylvania, and may make and adopt all necessary rules and regulations and by-laws not inconsistent and with the Constitution and laws of this Commonwealth, or of the United States, and shall have power to locate and maintain an office within this State for the transaction of business. Five members of the said council shall constitute a quorum for the transaction of business.

SECTION 3.—The said council shall organize at Harrisburg within ten days from the date of the organization of the three boards of medical examiners, and shall elect from its own number a president and a secretary who shall also act as treasurer, both of whom shall hold their offices for one year, or until their successors are chosen.

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SECTION 5.—The said Medical Council shall hold two stated meetings in each year at Harrisburg and may hold special meetings at such times and places as it may deem proper. It shall supervise the examinations conducted by the three State Boards of Medical Examiners of all applicants for license to practice medicine and surgery in this Commonwealth and shall issue licenses to practice medicine and surgery to such applicants as have presented satisfactory and properly certified copies of licenses from State Boards of Medical Examiners or State Boards of Health of

other States, as provided for in section thirteen of this act, or have successfully passed the examination of one of the three State Boards of Medical Examiners, but all such examinations shall be made by the State Boards of Medical Examiners established in section six of this act. And the said Medical Council shall have no power, duty or function except such powers, duties and functions as pertain to the supervision of the examinations of applicants for licenses to practice medicine and surgery, and to the issuing of licenses to such applicants as have successfully passed the examination of one of the State Boards of Medical Examiners, or have presented satisfactory and properly certified copies of licenses from State Boards of Medical Examiners, or State Boards of Health of other States, as provided for in section thirteen of this act.

Section 6.—It is further enacted that from and after the first day of March, Anno Domini one thousand eight hundred and ninety-four there shall be and continue to be three separate Boards of Medical Examiners for the State of Pennsylvania, one representing the Medical Society for the State of Pennsylvania, one representing the Homeopathic Medical Society of the State of Pennsylvania, one representing the Eclectic Medical Society of the State of Pennsylvania.

Each board shall consist of seven members, and each of said members shall serve for a term of three years from the first day of March next after his appointment. . . . .

Section 7.—Said boards shall be known by the name and style of Boards of Medical Examiners of the State of Pennsylvania. Every person who shall be appointed to serve on either of said boards shall receive a certificate of appointment from the Secretary of the Commonwealth.

Each of said boards shall be authorized to take testimony concerning all matters within its jurisdiction, and the presiding officer for the time being of either of said boards, or of any of the committees thereof, may issue subpœnas and administer oaths to witnesses. Each of said boards of examiners shall make and adopt all necessary rules, regulations and by-laws not inconsistent with the Constitution and laws of this State or of the United States, whereby to perform the duties and transact the business required under the provisions of this act; said rules, regulations and by-laws to be subject to the approval of the Medical Council of Pennsylvania established by this act.

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Section 9.—. . . . For the purpose of examining applicants for license each of said boards of medical examiners shall hold two or more stated or special meetings in each year, due notice of which shall be made public at such times and places as they may determine. At said stated or special meetings a majority of the members of the board shall constitute a quorum thereof, but the examination may be conducted by a committee of one or more members of the board of examiners duly authorized by said board.

SECTION 10.—The several boards of medical examiners shall, not less than one week prior to each examination, submit to the Medical Council of Pennsylvania questions for thorough examinations in anatomy, physiology, hygiene, chemistry, surgery, obstetrics, pathology, diagnosis, therapeutics, practice of medicine and materia medica; from the lists of questions so submitted the council shall select the questions for each examination, and such questions for each examination shall be the same for all candidates, except that in the departments of therapeutics, practice of medicine and materia medica, the questions shall be in harmony with the teachings of the school selected by the candidate.

SECTION 11.—Said examinations shall be conducted in writing in accordance with the rules and regulations prescribed by the Medical Council of Pennsylvania and shall embrace the subjects named in section ten of this act. After each such examination the board having charge thereof shall without unnecessary delay act upon the same. An official report of such action signed by the president, secretary, and each acting member of said board of medical examiners, stating the examination average of each candidate in each branch, the general average and the result of the examination, whether successful or unsuccessful, shall be transmitted to the Medical Council. Said report shall embrace all the examination papers, questions and answers thereto. All such examination papers shall be kept for reference and inspection for a period of not less than five years.

SECTION 12.—On receiving from any of said boards of medical examiners such official report of the examination of any applicant for license, the Medical Council shall issue forthwith to each applicant, who shall have been returned as having successfully passed said examination, and who shall have been adjudged by the Medical Council to be duly qualified for the practice of medicine, a license to practice medicine and surgery in the State of Pennsylvania. The Medical Council shall require the same standard of qualifications from all candidates except in the departments of therapeutics, practice of medicine and materia medica, in which the standard shall be determined by each of the boards respectively. Every license to practice medicine and surgery issued pursuant to this act shall be subscribed by the officers of the Medical Council and by each medical examiner who reported the licentiate as having successfully passed said examinations. It shall also have affixed to it by the person authorized to affix the same the seal of the Commonwealth.

Before said license shall be issued it shall be recorded in a book to be kept in the office of the Medical Council, and the number of the book and page therein containing said recorded copy shall be noted upon the face of said license. Said records shall be open to public inspection, under proper restrictions as to their safe keeping, and in all legal proceedings shall have the same weight as evidence that is given to the conveyance of land.

SECTION 13.—From and after the first day of July Anno Domini, one thousand eight hundred and ninety-four, any person not theretofore authorized to practice medicine and surgery in this State, and desiring to enter upon such practice, may deliver to the Secretary of the Medical Council, upon the payment of a fee of twenty-five dollars, a written application for license, together with satisfactory proof that the applicant is more than twenty-one years of age, is of good moral character, has obtained a competent common school education, and has received a diploma conferring the degree of medicine from some legally incorporated medical college of the United States, or a diploma or license conferring the full right to practice all the branches of medicine and surgery in some foreign country; applicants who shall have received their degree in medicine after the first day of July one thousand eight hundred and ninety-four, must have pursued the study of medicine for at least three years, including three regular courses of lectures, in different years, in some legally incorporated medical college or colleges, prior to the granting of said diploma, or foreign license. Such proof shall be made, if required, upon affidavit. Upon the making of said payment and proof the Medical Council, if satisfied with the same, shall issue to said applicant an order for examination before such one of the State Boards of Medical Examiners as the applicant for license may select. In case of failure at any such examination the candidate, after the expiration of six months and within two years, shall have the privilege of a second examination by the same board to which application was first made, without the payment of an additional fee: And it is provided further, That applicants examined and licensed by State Boards of Medical Examiners of State Boards of Health of other States, on payment of a fee of fifteen dollars to the Medical Council, and on filing in the office of the Medical Council a copy of said license certified by the affidavit of the president or secretary of such Board showing also that the standard of acquirements adopted by said State Board of Medical Examiners or State Board of Health, is substantially the same as is provided by sections eleven, twelve and thirteen of this act, shall without further examination receive a license conferring on the holder thereof all the rights and privileges provided by sections fourteen and fifteen of this act.

SECTION 14.—From and after the first day of March, Anno Domini one thousand eight hundred and ninety-four, no person shall enter upon the practice of medicine or surgery in the State of Pennsylvania unless he or she has complied with the provisions of this act, and shall have exhibited to the prothonotary of the court of common pleas of the county in which he or she desires to practice medicine or surgery, a license duly granted to him or her as hereinbefore provided, whereupon he or she shall be entitled upon the payment of one dollar to be duly registered in the office of the prothonotary of the court of common pleas in the said county, and any person violating any of the provisions of this act shall be guilty of a misdemeanor, and upon conviction thereof in the court of quarter sessions of the county wherein the offense shall have been com-

mitted, shall pay a fine or not more than five hundred dollars for each offense.

SECTION 15.—Nothing in this act shall be construed to interfere with or punish commissioned medical officers serving in the army or navy of the United States, or in the United States Marine Hospital service while so commissioned, or medical examiners of relief departments of railroad companies while so employed, or any one while actually serving as a member of the resident medical staff of any legally incorporated hospital, or any legally qualified and registered dentist exclusively engaged in the practice of dentistry, or shall interfere with or prevent the dispensing and sales of medicines or medical appliances by apothecaries, pharmacists, or interfere with the manufacture of artificial eyes, limbs, or orthopedical instruments or trusses of any kind for fitting such instruments on persons in need thereof, or any lawfully qualified physicians and surgeons residing in other states or countries, meeting registered physicians of this State in consultation, or any physician or surgeon residing on the border of a neighboring State and duly authorized under the laws thereof to practice medicine and surgery therein whose practice extends into the limits of this State: Provided, That such practitioner shall not open an office, or appoint a place to meet patients or receive calls, within the limits of Pennsylvania, or physicians duly registered in one county of this State called to attend cases in another county but not residing or opening an office therein. And nothing in this act shall be construed to prohibit the practice of medicine and surgery within this commonwealth by any practitioner who shall have been duly registered before the first day of March, Anno Domini one thousand eight hundred and ninety-four, according to the terms of the act, entitled "An act to provide for the registration of all practitioners of medicine and surgery," approved the eighth day of June, Anno Domini, one thousand eight hundred and eighty-one, and one such registry shall be sufficient warrant to practice medicine and surgery in any county in this commonwealth.

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SECTION 17.—All acts or parts of acts of Assembly inconsistent herewith shall be and are hereby repealed.

Approved—The 18th day of May, A. D. 1893.

"The Pennsylvania Board of Examiners has been unwilling to accept the examinations in medicine conducted in our adjacent States; hence the Medical Council of the State is unable to issue licenses upon the payment of fifteen dollars upon the basis of licenses granted in other States. Some time ago this question was tested in the courts and the action of the Pennsylvania Board was sustained."

(From a letter to the author from the Secretary of the Department of Public Instruction.)

PORTO RICO

Laws 1903.

An Act Providing for the Organization of a Board of Medical Examiners.

Be it enacted by the Legislative Assembly of Porto Rico.

Sec. 1.—The governor, with the advice and consent of the Executive Council, shall appoint five learned, skilled and capable physicians, who shall have been residents of the Island of Porto Rico for not less than five years preceding their appointment who shall constitute the Board of Examiners for the purpose of this Act. . . . .

Sec. 2.—. . . .

The Board of Examiners shall hold meetings for examinations at the seat of government on the first Tuesday of April and October of each year, and at such other times and at the same and other places as the Board may determine. . . . .

Sec. 3.—Every person hereinafter wishing to practice medicine or surgery, or any of the branches thereof or midwifery of any of their departments in this Island, shall apply to the said Board for a certificate or license so to do. Applications from said candidates shall be in writing and accompanied by proof that the applicant is a graduate of a medical school or institution in good standing and legally organized, and duly approved by the said Board of Examiners; if the diploma is found genuine, which fact the said Board of Examiners shall determine, and if the person presenting and claiming said diplama be the person to whom the same was originally granted, at a time and place designated by said Board, or at a regular meeting of said Board, said applicant shall be required to take an examination embracing those general subjects and topics, a knowledge of which is commonly and generally required or candidates for the degree of doctor of medicine by respectable medical colleges in the United States. The examination of those who desire to practice midwifery or any of the branches of medicine and surgery, shall be of such character as to determine the qualifications of the applicants to practice them. All examinations provided for in this act shall be conducted under rules and regulations prescribed by the Board, which shall provide for a fair and wholly impartial method of examination. After examination, such Board shall, if the candidate has been found qualified, grant a certificate or license to such candidate to practice medicine and surgery or any of the branches thereof or midwifery in Porto Rico; which said certificate can only be granted by the consent of not less than three members of said board, and which

said certificate shall be signed by the President and Secretary of said Board and attested by the seal thereof; *provided*, however, that all physicians and surgeons, who hold certificates granted by the now existing Board of Medical Examiners shall be exempt from the provisions of this section.

Sec. 4.—The Board may refuse to grant a certificate on account of unprofessional, dishonorable or immoral conduct. Before a certificate can be refused for such cause, the Board shall serve in writing upon the applicant a copy of any charge or charges against him, and appoint a day for hearing, at which the applicant or any witness in his behalf may appear and give testimony in refutation of such charges. . . . .

Sec. 5.—Every person obtaining a certificate from the Board, must within sixty days from the date thereof, have the same recorded in the office of the Secretary of Porto Rico and in the office of the Superior Board of Health. The Secretary of Porto Rico and the President of the Superior Board of Health shall endorse upon the certificate the date of record, and charge and receive the usual fees for such services, the fees to be paid by the applicant.

Sec. 6.—Applicants who possess diplomas from reputable medical colleges, and who may have been licensed by State Boards, may upon the payment of a fee of twenty-five (25) dollars, be licensed by the Board of Examiners without examination if the said Board of Examiners so decides. Medical Officers serving in the Army and Navy of the United States or in the United States Marine hospital service, are exempt from examination, but are required to be registered by the Superior Board of Health and to pay a fee of five dollars.

Sec. 7.—Any person practicing medicine or surgery or any other branches thereof or midwifery within the Island contrary to the provisions of this act, shall, for each violation of the provisions of this act, be guilty of a misdemeanor, and upon conviction thereof shall be fined not more than five hundred dollars nor less than fifty dollars, or by imprisonment for not more than ninety days nor less than thirty days or by both said fine and imprisonment, as the court may determine. Any person shall be regarded as practicing within the meaning of this act who shall append the letters M. D. (for Medical Doctor) to his or her name, who shall profess publicly to be a physician or surgeon, or who shall recommend, prescribe or direct for the use of any person, any drug, medicine, appliance, apparatus or other agency, whether material or not material, for the cure, relief, or palliation of any ailment or disease of the mind or body or for the cure or relief of any wound, fracture, or bodily injury, or other deformity, after having received or with the intent of receiving therefor, either directly or indirectly, any bonus, gift or compensation.

Sec. 8.—The fees for examination and for a certificate shall be as follows: ten dollars for an examination in medicine and surgery, and five dollars for a certificate if issued, for all other practitioners five dollars for an examination and five dollars for a certificate if issued.

For an examination in midwifery five dollars, and three dollars for a certificate if issued. All fees shall be paid in advance to the Treasurer of the Board of Medical Examiners, which fees shall defray the entire expenses of said candidate for examination before the said Board of Examiners.

Any one failing to pass the required examination shall be entitled to a second examination within six months without fee. And the moneys so received shall be turned over to the Treasurer of Porto Rico by the Treasurer of said Board, to be by him deposited in the Medical Board Fund, as hereinafter provided.

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RHODE ISLAND

Rhode Island Medical License Law. Chapter 165 of the General Laws. (As Amended November, 1901.) Of the Practice of Medicine.

Section 1.—It shall be the duty of each town and city clerk to purchase a book of suitable size, to be known as the "medical register" of each city or town, and to set apart one full page for the registration of each physician; and when any physician shall die or remove from the city or town, said clerk shall make a note of the same at the bottom of the page, and shall on the first day of January in each year transmit to the office of the state board of health a duly-certified list of the physicians of said city or town registered under this chapter, together with such other information as is hereinafter required, and perform such other duties as are required by this chapter; and such clerk shall receive the sum of fifty cents from each physician so registered, which shall be his full compensation for all the duties required under this chapter.

Sec. 2.—It shall be unlawful for any person to practice medicine or surgery in any of its branches, within the limits of this state, who has not exhibited and registered, in the city or town clerk's office of the city or town in which he or she resides, his or her authority for so practicing medicine as herein prescribed, together with his or her age, address, place of birth and the school or system of medicine to which he or she proposes to belong; and the person so registering shall subscribe and verify by oath, before such clerk, an affidavit concerning such facts, which, if wilfully false shall subject the affiant to conviction and punishment for perjury.

Sec. 3.—Authority to practice medicine under this chapter shall be a certificate from the state board of health, and said board shall, upon application, after examination, issue a certificate to any reputable physician who intends to practice medicine or surgery in this state and who shall present himself before the state board of health and pass in a satisfactory manner such examination as said board may require. Any physician so representing himself shall pay to said board the sum of ten dollars ($10) for each examination, and said fee shall in no case be returned, but shall be applied to pay the expenses of said board of health in conducting such examinations. Each certificate so issued shall be signed by the president and countersigned by the secretary of said board and shall be attested by the official seal, and not more than two dollars ($2) shall be charged for a certificate.

Sec. 4.—Nothing in this chapter shall be so construed as to author-

ize any itinerant doctor to register or to practice medicine in any part of this state.

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SEC. 6.—Nothing in this chapter shall be so construed as to discriminate against any particular school or system of medicine, or to prohibit gratuitous services in case of emergency; nor shall this chapter apply to commissioned surgeons of the United States army, navy, or marine hospital service, or to legally qualified physicians of another state, called to see a particular case, in consultation with a registered physician of this state, but who do not open an office or appoint a place in this state where they may meet patients or receive calls.

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SEC. 8.—Any person who, not being then lawfully authorized to practice medicine within this state, and so registered according to law, shall practice medicine or surgery or attempt to practice medicine or surgery, or any of the branches of medicine or surgery, after having received therefor or with the intent of receiving therefor, either directly or indirectly, any bonus, gift, or compensation, or who shall open an office with intent to practice medicine or shall hold himself out to the public as a practitioner of medicine, whether by appending to his name the title of doctor or any abbreviation thereof, or M. D., or any other title or designation implying a practitioner of medicine, or in any other way, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined fifty dollars, and upon each and every subsequent conviction shall be fined one hundred dollars and imprisoned thirty days, either or both, in the discretion of the court; and in no case when any provision of this chapter has been violated shall the person so violating such provision be entitled to receive compensation for services rendered.

INSTRUCTIONS.

APPLICATION FORMS MAY BE OBTAINED BY ADDRESSING THE SECRETARY OF THE BOARD.

1. Applicant must fill out in his or her own hand-writing the numbered blanks of the form, and the application must be in the hands of the Secretary of the State Board of Health at Providence at least 14 days before examination.

2. The fee of ten dollars, prescribed by law, must accompany the application. Unless paid in person the fee should be transmitted by postal money order, draft, or check, and made payable to the Secretary of the State Board of Health. No responsibility will be assumed for fees transmitted by mail in any other form. This fee, as provided in the act, "shall in no case be returned." The fee for certificate when issued is two dollars.

3. If the applicant has a literary, or scientific, or medical degree, the diploma should be presented at the time of the examination.

4. Examinations shall be made in writing, and in English, and of a practical character, but sufficiently strict to test the qualifications of the applicant as a practitioner.

Examinations will be presented upon the following subjects or groups of subjects: 1, Anatomy and Physiology; 2, Materia Medica and Chemistry; 3, Pathology; 4, Surgery; 5, Theory and Practice; 6, Obstetrics and Gynecology; 7, Hygiene and Medical Jurisprudence.

5. Examinations will be held at the State House, room 315, commencing at 9 a. m., on the first Thursday in January, April, July, and October.

6. Ten questions will be presented upon each subject or group of subjects. An average of seventy-five per cent (75) of correct answers will be required.

SOUTH CAROLINA

Laws of 1904. No. 292.

An Act to Regulate the Practice of Medicine in South Carolina, to Provide for a State Board of Medical Examiners and to Define their Duties and Powers.

Sec. 1. *Be it enacted by the General Assembly of the State of South Carolina,* That on and after the approval of this Act, no person shall practice medicine or surgery within the State, unless he or she is twenty-one years of age, and either has been heretofore authorized so to do, pursuant to the laws in force at the time of his or her authorization, or is hereafter authorized to do so by subsequent sub-divisions of this Act.

Sec. 2.—No person shall be regarded as practicing medicine, within the meaning of this Act, who shall treat, operate on, or prescribe for any physical ailment of another, except those engaged solely in the practice of osteopathy. But nothing in this Act shall be construed to prohibit service in cases of emergency, or the domestic administration of family remedies.

Sec. 3.—There shall be established a State Board of Medical Examiners, composed of eight reputable physicians or surgeons, one from each of the seven Congessional Districts, and one from the State at large, to be nominated by the State Medical Association, and appointed and commissioned by the Governor. . . . .

Provided, That no applicant who has failed or who may hereafter fail in his examination by the State Board of Medical Examiners, shall be allowed to present himself or herself before the State Board of Homeopathic Examiners for examination: *Provided, further,* That no graduate of any medical college requiring less than a four years' course of study will be eligible for examination before the Board.

Sec. 4. (As amended by Laws of 1905)—Said Board of Medical Examiners shall meet regularly, at Columbia, South Carolina, on the second Tuesday in June of each year, and continue in session until all applicants are duly examined. A majority of said Board shall constitute a quorum for the transaction of business. At their first meeting they shall organize by the election of a Chairman and a Secretary, who shall also be Treasurer, and said board shall have power to call extra meetings, and to make all necessary by-laws and rules for their government.

Sec. 5. (As amended by Laws of 1905)—It shall be the duty of

said Board, when organized, to examine all candidates for examination, as hereinafter provided and transcribed, and to pass upon their qualifications and fitness to practice medicine in this State, and to give to each successful applicant a certificate to that effect, upon the payment of ten dollars to the Treasurer of said Board, one-half of which shall be returned if the applicant fails to secure a certificate of qualification. Such certificate of qualification shall entitle the holder or holders thereof, respectively, to be registered as a lawful practicing physician by the Clerk of Court of the County in which he or she or they may reside, upon payment to said Clerk of Court of a fee of twenty-five cents for each registration. No physician will be considered as a legally qualified practitioner, or as having fully complied with the law until he shall have obtained said registry. In the interim between the meetings of the Board, the President and Secretary of the Board shall be allowed to grant temporary license to practice medicine until the next regular meeting of the Board to such persons as would, under the above Section, be eligible for examination. Said temporary license shall not entitle the holder to registry with the Clerk of the Court of the County in which he resides, but at the next regular meeting of the Board the applicant must come up for the regular examination for permanent license.

Sec. 6. (As amended by Laws of 1905)—All persons who hold diplomas from any medical college or school of established reputation, given prior to the passage of this Act, and who present certificates of their good character, and of their sobriety, from some reputable person or persons known to the Board, and who give evidence of sufficient preliminary education (equivalent to the possession of a teacher's first grade certificate), shall be eligible for examination before the Board, irrespective of their time for attendance upon medical lectures; but no person who shall graduate after the passage of this Act shall be eligible to appear before the Board for examination unless he or she shall give evidence, in addition to sufficient preliminary education, that he or she has attended four full courses of lectures of at least twenty-six weeks each, no two courses being in the same year, and has received a diploma of M. D. therefrom: *Provided*, That nothing in this Act contained shall be construed to prevent the State Board of Medical Examiners from admitting as eligible for examination before said Board on both the junior and senior curriculum prescribed in Section 7 of this Act, any person who satisfies said Board that he or she has been regularly admitted to advance standing in some medical college or school of established reputation, requiring a four years' course of study, and has received a diploma of M. D. therefrom, and is otherwise eligible under the provisions of this Act.

Sec. 7.—The Curriculum of the State Board of Medical Examiners shall be divided into two schools; the first comprising the junior or primary branches of medical education, hereafter to be designated as the *Junior Curriculum*. The second, comprising the senior and clinical courses of medical education, hereafter to be designated as the *Senior*

Curriculum. The *Junior Curriculum* shall comprise the following branches, namely;

1. General Anatomy,
2. Physiology and Histology,
3. Materia Medica and Medical Botany,
4. Chemistry, Organic and Inorganic and Medical Physics,
5. Bacteriology and Pathology.

The *Senior Curriculum* shall comprise:

1. Anatomy, Regional or Surgical,
2. Practical Hygiene and Sanitary science, State Medicine,
3. Practical Urinalysis, Urinary Microscopy,
4. Therapeutics and Toxicology,
5. Surgery, General and Special, Surgical Proceedure,
6. Practical Medicine and Diseases of Children,
7. Practical Obstetrics and Gynæcology,
8. Medical Jurisprudence.

Said examinations shall be conducted either in writing or orally, or both, at the discretion of the Board.

SEC. 8.—All applicants before the Board, holding a diploma from a four year graded medical college of established reputation, whether in or out of the state, who have pursued a study of four separate courses, and have attained a mark of not less than seventy-five percent, on each individual branch of their curriculum, as evidenced by certificate from the Dean of their college, shall be exempted from examination in the Junior Curriculum, and shall be examined only on those subjects contained in the Senior Curriculum, as heretofore outlined. Those applicants who hold diplomas issued by chartered medical colleges, but whose term of attendance has been less than four years, as above stated, must pass upon both the Junior and Senior Curriculum, as must also those attending a four years' course who cannot produce a certificate showing that they have attained a mark of seventy-five percent. on all branches of their college curriculum.

SEC. 9.—The Board shall be empowered without examination to endorse upon receipt of the license fee of five dollars, the licenses issued by other State Boards having an equal standard, *provided*, Said other State Board accord to the licenses of the South Carolina State Board the same courtesy; and said other Sate Board licenses; when endorsed, shall entitle the holder to registry in this State, and to all the rights and privileges thereby granted.

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SEC. 13.—It shall be unlawful for any person or persons to practice medicine in this State who has failed to comply with the provisions as above recited. . . . .

SEC. 14.—In no case, wherein the provisions of this Act shall have been violated, shall any person so violating be entitled to receive a compensation for services rendered.

But all persons now practicing, in accordance with the law now in force, or who may hereafter practice medicine or surgery, as herein provided, shall be entitled to charge, sue for and collect for their services.

SEC. 15.—Upon the refusal of said Board to grant a license to any applicant, any appeal may be had to the Governor, who may order a re-examination of the applicant, to be held in the presence of the Dean of the Faculty of any medical college in this State, and a Committee composed of seven practicing physicians.

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Approved the 27th day of February, A. D., 1904.

SEC. 7.—Nothing in this Act shall affect the practice of osteopaths as provided for in an Act approved Feb. 27th, 1902.

Approved the 4th day of March, A. D., 1905.

SOUTH DAKOTA

MEDICAL LAW IN SOUTH DAKOTA WITH REFERENCE TO MEDICAL EXAMINERS. APPROVED MARCH 5, 1903. CHAPTER 176. ESTABLISHING A BOARD OF MEDICAL EXAMINERS.

Be it Enacted by the Legislature of the State of South Dakota:

§1. *Board Created.*—There is hereby created a board of medical examiners for the purpose of examination, regulation, licensing and registration of physicians and surgeons in the State of South Dakota. Said board shall consist of seven members, who shall have been residents of the State of South Dakota for not less than five years preceding their appointment not more than two of whom shall be from the same county.

§2. *Governor to Appoint.*—The governor shall immediately upon the taking effect of this act appoint seven skilled and capable physicians who shall constitute said board. . . . .[1]

§3. *Board—Of Whom Consist.*—The said board shall consist of not more than four members from the school known as Regular, not more than two from the school known as Homeopath, and not more than one from the school known as Eclectic. Five members of this board shall constitute a quorum for the transaction of business.

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§5. *Meetings—When Held.*—The Board shall hold two regular meetings each year, beginning on the second Wednesday of July, and the second Wednesday of January each year, and such additional meetings at such times and at such places as the board may deem advisable. The board shall have power to make rules and regulations for the government of the said board and its officers, and for the proper discharge of its duties.

§6. *Record Must Be Kept.*—Said Board shall keep a record of all proceedings thereof, and also a record or register of all applicants for a license, together with his or her age, time spent in the study of medicine, and the location and name of all the institutions granting to such applicants degrees or certificates of lectures in medicine or surgery such register shall also show whether such applicant was rejected or licensed under this act, said record or register shall be prima facie evidence of all matters therein recorded. No member of the said board shall belong to the faculty of any medical college or university nor shall any one of them be financially interested in the manufacture or sale of drugs, or the practice of pharmacy.

§7. *Application for License—Qualifications of Applicant.*—On and

[1]Unimportant amendment in 1905 Laws.

after the taking effect of this act all persons desiring to begin the practice of medicine or surgery or obstetrics in any of their branches in this state shall make application to said board for a license to practice medicine, surgery or obstetrics in the State of South Dakota. Such license shall be granted to such applicants who shall give satisfactory proofs of being at least twenty-one (21) years of age and of good moral character, but only on compliance of the following conditions; the applicant shall be given such license if he shall pass an examination before the board upon the following subjects: Anatomy, physiology, chemistry, pathology, therapeutics, practice of medicine, surgery, obstetrics, gynecology, disease of the eye and ear, bacteriology, medical jurisprudence, and such other branches as the board may deem advisable, and in addition thereto shall present evidence of having attended four full courses of lectures of at least twenty-six (26) weeks each in a legally organized and reputable medical college recognized by the board of medical examiners, no two courses being in the same year and of having received a diploma from a legally organized and reputable medical college, which shall be in good standing as shall be determined by the board, and said diploma must be submitted to the board for inspection and verification provided that the four courses of lectures of six months each shall not apply to applicants who graduated prior to 1898.

§8. *Examination—How Conducted.*—Said examination shall be conducted as follows: *First*, the applicant shall before being permitted, to take the examination pay to the secretary of the board an examination fee of twenty dollars ($20). *Second*, the examination shall be in writing, oral or both as the board may determine. *Third*, the questions on all subjects except therapeutics and practice of medicine shall be such as may be answered alike by all schools of medicine. The applicant shall if possible be examined in therapeutics and practice of medicine by those members of the board belonging to the same school as the applicant and a license and certificate shall not be refused any applicant because of his adherence to any particular school of medicine. The average percentage of at least seventy-five per cent of correct answers shall be required of every applicant. Any applicant who shall not pass the said examination, shall be eligible to a second examination at the next regular meeting of the board or at such time as the board may designate without an additional examination fee.

§9. *License.*—Said board shall grant a license to practice medicine and surgery and obstetrics in all their branches in the State of South Dakota to each applicant who has satisfactorily passed the said examination and has fulfilled all other requirements of this act. Said license can only be granted by the consent of not less than five (5) members of the said board and which said license shall be signed by the president and secretary of the said board and attested by the seal of the board. All examination papers together with the lists of questions answered shall be kept for reference and inspection for a period of not less than three (3) years.

§10. *License without Examination—When*—(As amended in 1907).—The said board may at its discretion, upon the presentation of a certificate of registration or license issued to the applicant by the examining board of any state or territory of the United States or of the District of Columbia, and upon the payment of the license fee herein provided, license such applicant without examination, in either of the following cases, to wit: (1) Where the legal requirements of the examining board of such state, territory or District of Columbia shall have been at the time of issuing such certificate of registration or license therein, in no degree or particular less than those of this state; or (2) where the applicant at the time of the certificate of registration or license was issued to him in such state, territory or District of Columbia was the legal possessor of a diploma issued to him at a time prior to the time when an examination test was required by the laws of such state, territory or District of Columbia by a medical college in good standing therein, and which is recognized by the board hereby created as a reputable medical college; and has been in active practice up to the time of presenting such application; provided, that the provisions of this section shall be held to apply only to the certificates of registration or licenses issued by such of said medical examining boards as accept and register or license, without examination, persons who are authorized by law to practice medicine, surgery or obstetrics in this state. Each applicant upon making application under the provisions of this section shall pay to the secretary of the board a license fee of twenty dollars.

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§15. *License Must be Recorded.*—The person receiving a license to practice shall have the same recorded in the office of the register of deeds in the county where he resides and practices. The said register of deeds shall in July and January of each year furnish the secretary of the state board of medical examiners a list of all licenses so recorded.

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§19. *Itinerant Physicians Must Procure Itinerant Licenses.*—Any physician practicing medicine, surgery or obstetrics or professing or attempting to treat, cure or heal diseases, ailments or injuries by any medicine, appliance or method who goes from place to place, or from house to house, or by circulars, letters, or advertisements, solicits persons to meet him or her for professional treatment at places other than his office at the place of his permanent residence is hereby declared to be an itinerant physician, and shall in addition to the ordinary physician's license as in this act provided procure an itinerant's license from the state board of medical examiners for which he shall pay to the secretary of the board the said sum of five hundred dollars ($500) per annum upon the payment of said sum of five hundred dollars ($500) the board shall issue to the applicant therefor, a license to practice within the state as an itinerant physician for one year from the date thereof. The board may

for the same reasons as specified in Sections 11, 12 and 13 of this act refuse to issue such itinerant's license, or having issued it, may revoke it for the same reasons as specified in sections 11, 12 and 31 thereof.

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§22. *This Act Not Applicable—When.*—This act shall not apply to the commissioned surgeons of the United States army, navy, or marine hospital service in actual performance of their duties, nor to regularly licensed physicians or surgeons from outside this state in actual consultation with physicians of this state nor to dentists, or osteopaths in the legitimate practice of their profession nor to Christian Scientists as such, who do not practice medicine, surgery or obstetrics by the use of any material, remedies or agencies, nor to resident physicians and surgeons of this state regularly licensed and practicing in this state at the time of the taking effect of this act.

Provided, however, that the license heretofore or hereafter granted to any physician or surgeon may be revoked for the same reason, and in the same manner as stated and provided in sections 12 and 13 hereof.

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TENNESSEE

EXTRACTS FROM THE MEDICAL LAW OF TENNESSEE APPROVED APRIL 22, 1901. CHAPTER 78. HOUSE BILL NO. 478.

SECTION 1.—BE IT ENACTED BY THE GENERAL ASSEMBLY OF THE STATE OF TENNESSEE, That no person shall practice medicine in any of its departments within this state unless and until such person shall have obtained a certificate of license from the State Board of Medical Examiners hereinafter created, and shall have recorded it in the County Court Clerk's office in the county or counties in which he proposes to practice; Provided, however, that the provisions of this Act shall not apply to any person or persons who at the time of its passage are duly and regularly licensed by law to practice medicine in any of its branches in this State, and provided further, that the provisions of this Act shall not apply to any graduate of a reputable medical college, who has been a practitioner of medicine or surgery, for more than 10 years in the State of Tennessee, at the date of the passage of this Act. (As amended in 1905.)

SEC. 2.—BE IT FURTHER ENACTED, That there shall be a Board, to be known as the State Board of Medicial Examiners, and to consist of six graduated physicians of not less than six years' experience each in the practice of medicine or surgery, one or both, two of whom shall reside in each grand division of the State, and whose duty it shall be to examine into the qualifications of all applicants for certificates of license to practice medicine or surgery in this State; Provided, however, that the three schools of medicine shall be represented on said Board of Examiners as follows: Four representatives from the regular school of medicine, one from the eclectic, and one from the homeopathic school of medicine: and, provided, also, that no member of said Board shall be connected with any medical college of the State or State Board of Health.

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SEC. 6.—BE IT FURTHER ENACTED, That persons desiring to obtain a certificate of license to practice medicine or surgery in this State shall make application therefor in writing to said State Board of Medical Examiners, which application shall be accompanied by the examination fees hereinafter prscribed, and by satisfactory proof that the applicant is of good moral character. When these preliminary requirements are satisfied, the applicant shall then present himself before the Board for examination upon the following branches, viz.: Anatomy, physiology, chemistry, pathology, surgery, obstetrics, materia medica, and practice; but the member or members of the Board representing each

separate school of medicine shall have the right to examine all applicants of that school in the branches peculiar to the teachings of that school, and the Board shall accept the grade placed by such members or member upon such special branches; Provided, however, that graduates of any reputable medical college in the State of Tennessee shall, until June 1, 1902, be granted a certificate of license by said Board without reference to the number or lengths of terms attended, and without the examination hereinabove prescribed; but this proviso shall cease and determine after June 1, 1902.

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SEC. 8.—BE IT FURTHER ENACTED, That, if the applicant for examination shall thereupon be found worthy and competent by the Board it shall issue to him a certificate of permanent license, in accordance with the facts in each case, to practice medicine or surgery in this State.

SEC. 9.—BE IT FURTHER ENACTED, That, in order to prevent delay and inconvenience, the two members of the Board of any grand division of the State may grant a certificate of temporary license to any applicant who is permanently located as a resident of some designated place in that division of the State, upon satisfactory evidence to them that such applicant possesses the qualifications hereinabove required, and upon examination by them of such applicant in the subjects named in Section 6 of this Act, and make report thereof to the next regular meeting of the Board. Such temporary license shall not continue in force longer than until the conclusion of the next regular meeting of the Board, and shall in no case be granted within six months after the applicant has been refused a certificate of license by the Board. (As amended in 1903.)

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SEC. 11.—BE IT FURTHER ENACTED, That the Board is empowered to demand a fee of ten dollars for an examination for a certificate of permanent license, and five dollars for an examination for a certificate of temporary license, and to demand for the issuance of a certificate of permanent license five dollars, and for the issuance of a temporary license one dollar.

SEC. 12.—BE IT FURTHER ENACTED, That any person thus receiving a certificate of license, whether permanent or temporary, from the State Board of Medical Examiners shall forthwith have it recorded in the office of the County Court Clerk of the county in which he proposes to practice, and the date of such recording shall be endorsed thereon; and such license, when so recorded shall not be collaterally questioned in any legal proceeding. Until the license is recorded the holder shall not exercise any of the rights or privileges therein conferred, and, in case said license is not recorded within three months from the date of its issuance, it shall become invalid. The Clerk shall be paid a fee of fifty cents for recording said certificate. Any registered

physician removing his residence from one county in this State to another, in order to practice medicine, shall in like manner record the certificate of license in the county to which he removes, and the holder of the certificate shall pay to the County Court Clerk the usual fee for so doing. Practitioners who have registered in the county in which they reside may go from one county to another on professional business without being required to register.

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SEC. 19.—BE IT FURTHER ENACTED, That any person shall be regarded as practicing medicine within the meaning of this Act, who shall treat or profess to treat, operate on or prescribe for any physical ailment or any physical injury to or deformity of another; Provided, that nothing in this section shall be construed to apply to the administration of domestic or family remedies in cases of emergency, or to the laws regulating the practice of dentistry; and this Act shall not apply to surgeons of the United States army, navy, or marine hospital service, or to any registered physician or surgeon of other States when called in consultation by a registered physician of this State, or to midwives or to veterinary surgeons, or to osteopathists not giving or using medicine in their practice, or to opticians or to Christian scientists.

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LAWS OF 1907.

SEC. 1.—. . . . And, *provided, further*, that any person having regularly issued certificate of license to practice medicine or surgery in the State of Tennessee, whether issued by the County Court Clerk of the county of the practitioner's residence at the time of its issuance or by the State Board of Medical Examiners, and who has failed to have same regularly recorded in the office of the County Court Clerk of county in which said licensee then practiced or now practices within the time directed by this Act or said former Acts may have said certificate renewed or validated for registration by presenting said original certificate to any member of the State Board of Medical Examiners within sixty days from the date of the passage of this Act, who shall write thereon, "Renewed this . . . . day of . . . . 1907," inserting the true date and signing his name thereon; and such certificate, when so renewed, may be recorded in the various offices in the County Court Clerks of the State as other regular certificates; *Provided*, it is so recorded within thirty days from the date of such renewal. For every such renewal the applicant shall pay and the said member of the State Board shall collect one dollar, which shall be paid over to said Board at its next regular or called meeting after this amendment shall expire by its own limitations.

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SEC. 3.—Be it further enacted, That the State Board of Medical Examiners of Tennessee be, and is hereby, permitted to accept certificates of license from other States reqiring the same or higher standards of medical examinations in lieu of an examination, but of this matter of reciprocity of licensure this Board shall be the sole judge. The same fees shall be required for verifying certificates of license from other States and issuing license to parties as are demanded for examining and licensing other applicants for certificates of permanent license.

TEXAS

Extracts from the Law Regulating the Practice of Medicine in the State of Texas. Laws of 1907. Chapter 123.

Practice of Medicine—Regulating same.

Be it Enacted by the Legislature of the State of Texas:

Section 1.—That a board, to be known as the Board of Medical Examiners for the State of Texas, is hereby established. Said board shall consist of eleven men learned in medicine. . . . . The *word* "medicine" as used in this section shall have the same meaning and scope as given to it in Section 13 of this act

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Sec. 4.—From and after the passage of this act it shall be unlawful for any one to practice medicine in any of its branches upon human beings within the limits of this State who has not registered in the District clerk's office of the county in which he resides his authority for so practicing, as herein prescribed, together with his age, post-office address, place of birth, school of practice to which he professes to belong, subscribed and verified by oath, which, if willfully false, shall subject the applicant to conviction and punishment for false swearing as provided by law. The fact of such oath and record shall be indorsed by the district clerk upon the certificate. The holder of the certificate must have the same recorded upon each change of residence to another county, and the absence of such record shall be prima facie evidence of the want of possession of such certificate.

Sec. 5.—It is hereby made the duty of the district clerk of each county in this State to purchase a book of suitable size, to be known as the "medical registry" of such county, and set apart one full page for the registration of each physician, and to record in the same the name and record of each practitioner who presents a certificate from the State Board of Examiners, issued under this act. The clerk shall receive the sum of one dollar from each physician so registered, which shall be his full compensation for all duties required under this act. When any physician shall die or remove from the county, or have his license revoked, it shall be the duty of said clerk to make a note of facts at the bottom of the page as closing the record. On the first day of January in each year said clerk shall, on request of the board, certify to the office of the State Board of Medical Examiners a correct list of the physicians then registered in the county, together with such other information as said board may require. Any district clerk upon conviction of knowingly violating any of the provisions of this act,

shall be fined not more than fifty dollars. A copy from the medical register pertaining to any person certified to by said clerk under the seal of said court; also a certificate issued by said officer certifying that any person named has or has not registered in said office as required by this act, shall be admitted as evidence in all trial courts.

SEC. 6.—Within one year after the passage of this act all legal practitioners of medicine in this State, who, practicing under the provisions of previous laws, or under diploma of a reputable and legal college of medicine, have not already received license from a State Medical Examining Board of this State, shall present to the Board of Medical Examiners for the State of Texas documents, or legally certified transcripts of documents, sufficient to establish the existence and validity of such diplomas or of the valid and existing license heretofore issued by previous examining boards of this State, or exemption existing under any law, and shall receive from said board verification license, which shall be recorded in the district clerk's office in the county in which the licentiates may reside. Such verification license shall be issued for a fee of fifty cents to all practitioners who have not already received a license from the State Board of Medical Examiners of this State. It is especially provided that those whose claims to State licenses rest upon diplomas from medical colleges recorded from January 1, 1891, to July 9, 1901, shall present to the State Board of Medical Examiners satisfactory evidence that their diplomas were issued from bona fide medical colleges of reputable standing, which shall be decided by the Board of Medical Examiners before they are entitled to a certificate from said board. The board may, at its discretion, arrange for reciprocity in license with the authorities of other States and Territories having requirements equal to this established by this act. License may be granted applicants for license under such reciprocity on payment of twenty dollars.

SEC. 7.—All applicants for license to practice medicine in this State who are not licensed under the provisions of the previous section must successfully pass an examination before the Board of Medical Examiners established by this act. Applicants to be eligible for examination must present satisfactory evidence to the Board that they are more than twenty-one years of age, of good moral character and graduates of bona fide, reputable medical schools. Such schools shall be considered reputable within the meaning of this act whose entrance requirements and courses of instruction are as high as those adopted by the better class of medical schools of the United States, whose course of instruction shall embrace not less than four terms of five months each. Application for examination must be made in writing under affidavit to the secretary of the board, on forms prepared by the board, accompanied by a fee of fifteen dollars; except when an applicant desires to practice obstetrics alone the fee shall be five dollars. Such applicants shall be given due notice of the date and place of examination. Applicants to practice obstetrics in the State of Texas, upon proper application shall be examined by the board in obstetrics only, and upon

satisfactory examination shall be licensed to practice that branch only; provided, this shall not apply to those who do not follow obstetrics as a profession; and who do not advertise themselves as obstetricians or midwives, or hold themselves out to the public as so practicing. In case any applicant, because of failure to pass examination, be refused a license, he or she shall, after one year, be permitted to take a second examination without an additional fee.

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SEC. 9.—All examinations shall be conducted in writing and in such manner as shall be entirely fair and impartial to all individuals and every school of medicine, the applicants being known by numbers, without names or other method of identification on examination papers by which members of the board may be able to identify such papers, until after the applicants have been granted licenses or rejected. Examinations shall be conducted on the scientific branches of medicine only, and shall include anatomy, physiology, chemistry, histology, pathology, bacteriology, physical diagnosis, surgery, obstetrics, gynecology, hygiene, and medical jurisprudence upon satisfactory examination under the rules of the board, applicants shall be granted licenses to practice medicine. All questions and answers, with grades attached, shall be preserved for one year. All applicants examined at the same time shall be given identical questions in each of the above branches. All certificates shall be attested by the seal and signed by all members of the board, or a quorum thereof.

SEC. 10.—Nothing in this act shall be construed as to discriminate against any particular school or system of medical practice. This act shall not apply to dentists legally qualified and registered under the laws of this State who confine their practice strictly to dentistry; nor to nurses who practice only nursing; nor to masseurs, in their particular sphere of labor, who publicly represent themselves as such; nor to commissioned or contract surgeons of the United States Army, Navy, or Public Health and Marine Hospital Service, in the performance of their duties, but such shall not engage in private practice without license from the Board of Medical Examiners; nor to legally qualified physicians of other States called in consultation, but who do not open offices or appoint places in this State where patients may be met or called to see. This act shall be so constructed as to apply to persons other than licensed druggists of this State not pretending to be physicians, who offer for sale on the streets or other public places remedies which they recommend for the cure of disease.

SEC. 11.—The State Board of Medical Examiners may refuse to admit persons to its examinations or to issue the certificates provided for in this act for any of the following causes:

First.—The presentation to the board of any license, certificate or diploma which was illegally or fraudulently obtained, or when fraud or deception has been practiced in passing the examination.

Second.—Conviction of a crime of the grade of a felony, or which involves moral turpitude, or procuring, or aiding or abetting the procuring of a criminal abortion.

Third.—Other grossly unprofessional or dishonorable conduct of a character likely to deceive or defraud the public, or for habits of intemperance or drug addictions calculated to endanger the lives of patients; provided, that any applicant who may be refused admittance to examination before said board shall have his right of action to have such issue tried in the district court of the county in which some member of the board shall reside.

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SEC. 13.—Any person shall be regarded as practicing medicine within the meaning of this act (1) who shall publicly profess to be a physician or surgeon and shall treat, or offer to treat any disease or disorder, mental or physical, or any physical deformity or injury, by any system or method, or to effect cures thereof.

(2) Or who shall treat or offer to treat any disease or disorder, mental or physical, or any physical deformity or injury by any system or method or to effect cures thereof and charge therefor, directly or indirectly, money or other compensation.

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UTAH

Extracts from an Act Regulating the Practice of Medicine in the State of Utah. Laws of 1907. Chapter 88.

Regulating the Practice of Medicine and Surgery.

Be it Enacted by the Legislature of the State of Utah:

Section 1. *Board Appointed. Qualifications of Members. Vacancies.*—There shall be appointed by the Governor at each regular session of the Legislature, by and with the consent of the Senate, a State Board of Medical Examiners, who shall consist of nine members, who shall be representatives of the various recognized Schools of Medicine, each of whom shall be at the time of his appointment a licensed graduate practitioner of medicine in this State. Each person so appointed shall qualify by taking an oath before a Judge of the District court, that he is a graduate of a legally chartered medical college in good standing, and that he will faithfully perform the duties of his office, and upon the qualification of every person appointed as aforesaid, he shall hold his office until his successor is appointed and qualified. . . . .

Sec. 2. *Board Must Organize. Powers and Duties. Certificate.*—Said board shall organize immediately after its appointment by selecting from its members, a President, Secretary and Treasurer. Five members of the board shall constitute a quorum. The board shall have a seal with which it shall attest its official acts. Any member of the board shall have authority to administer oaths and the board shall have authority to take testimony in all matters, relating to the duties of the board. The board shall have power to examine any person who furnishes satisfactory proof of having received a degree or diploma from a legally chartered medical school, which at the time of granting such diploma required at least the following hours of study; Anatomy, 420, histology, 90, physiology, 300, chemistry, 300, therapeutics, 90, bacteriology, 140, pathology, 240, physical diagnosis, 100, surgery, 540, obstetrics, 160 and gynecology 160; a leeway of ten percent being allowed, or a minimum total of 2286 hours. And any legally chartered school making the foregoing requirements shall be deemed a "recognized school of medicine." If the applicant has received a certificate from a high school of the first grade or educational attainment equivalent thereto, and, if upon examination of such person by the board, the said board shall be satisfied that the applicant is qualified to practice medicine and surgery, then the said board shall have power to issue a certificate to such person so qualified and examined. The board shall issue two forms of certificates or license, one for persons holding such a degree or

diploma who has been examined and favorably passed upon by the board, and another for persons desiring to practice obstetrics under the provisions of section thirteen. Certificates or licenses shall be signed by all members of the board granting them.

SEC. 3. *Fee.*—The fee for the examination provided for in the last preceding section shall be fifteen dollars, which shall be paid to the Treasurer of the Board of Medical Examiners.

SEC. 4. *Non-graduate Practitioners.*—No non-graduate licensed under the provisions of the territorial Legislature shall in any way advertise as a doctor, physician or surgeon, but shall, if he advertise at all, do so as a licensed non-graduate practitioner of medicine. The Secretary of the Board shall enter, without fee, upon the register to be kept by him, the names of all persons to whom certificates are issued as physicians and surgeons.

SEC. 5.—*Certificate to be Recorded.*—Every person holding a certificate from the said board shall have it recorded in the office of the Recorder of the county in which he resides, within three months from its date, and the date of record shall be endorsed thereon. Until such certificate is recorded as herein provided, the holder thereof shall not exercise any of the privileges conferred therein to practice medicine. Any person removing to another county to practice medicine shall record the certificate in like manner in the county to which he removes, and the holder of the certificate shall pay the Recorder the usual fees for recording such certificates.

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SEC. 9. *"Unprofessional Conduct," Defined.*—The words "unprofessional conduct" as used in this act, are hereby defined to mean any of the following acts, to wit:

First.—Offering or attempting to procure or aid or abet in procuring a criminal abortion.

Second.—The procuring or aiding in procuring a criminal abortion.

Third.—The obtaining of any fee on the assurance that a manifestly incurable disease can be permanently cured.

Fourth.—The willfully betraying a professional secret.

Fifth.—All advertising of medical business in which grossly improbable statements are made.

Sixth.—All advertising of medicines, or of any means, whereby the monthly periods of women can be regulated or the menses re-established if suppressed.

Seventh.—Conviction of any offense involving moral turpitude.

Eighth.—Habitual intemperance or any excessive use of drugs or gross immorality.

. . . . . .

SEC. 11. *Practicing Medicine Defined.*—Any person shall be regarded as practicing medicine within the meaning of this act who shall

diagnose, treat, operate upon, prescribe or advise for, any physical ailment of another for a fee, or who shall hold himself out by means or signs, cards, advertisements, or otherwise, as a physician or surgeon; but nothing in this act shall be construed to prohibit services in cases of emergency, or the administration of family remedies, nor prevent medical officers of the United States Army from the discharge of their official duties, nor to prohibit visiting physicians in the act of consultation, nor shall anything in this act be construed to apply to those who heal only by spiritual means without pretending to have a knowledge of the science of medicine.

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SEC. 14. *Meetings of the Board.*—The board of Medical Examiners shall meet on the first Monday in January, April, July, and October, of each year, at ten o'clock A. M., and such other times as the President of the Board shall deem necessary.

The place of meeting shall be at the State Capitol.

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SEC. 16. *Examination May Be Waived, When.*—The said board may in its discretion accept and register upon the payment of the registration fee of twenty-five dollars and without examination of the applicant any certificate which shall have been issued to him by the Medical Examining Board of the District of Columbia, or any State or Territory of the United States; *provided, however,* that the applicant has received a degree or diploma from a legally chartered medical school, the requirements of which shall have been at the time of granting such diploma in no particular less than those prescribed by the Association of American Medical Colleges for that year; and *provided further* that the legal requirements of such medical examining board of such State or Territory shall have been at the time of issuing such certificate in no degree or particular less than those of this State at the time when such certificate shall be presented for registration to the board created by this act; and *provided further* that the provisions in this paragraph contained shall be held to apply only to such of said Medical Examining Boards of such States and Territories as accept and register the certificates granted by this board without examination by said boards of the one holding such certificates.

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VERMONT

Medical License Laws of Vermont. No 133. An Act Creating a Board of Medical Registration.

It is hereby enacted by the General Assembly of the State of Vermont:

Section 1.—A state board of medical registration is hereby created. Said board shall consist of seven (7) members, three (3) of whom shall be of the regular school of practice; two (2) of the homeopathic school of practice, and two (2) of the eclectic school of practice, and each shall be a graduate of a legally chartered medical college or university, having the power to confer the degree of doctor of medicine and surgery. . . . .

Sec. 2. . . . . The appointments as provided in this section shall be made from a list to be nominated by the Vermont medical society, Vermont homeopathic medical society, or Vermont eclectic medical society, according as the term of office of the members representing each of these different schools of practice is about to expire, said list to contain at least twice the number to be appointed. . . . .

In case, however, that no nominations are made by the said medical societies, then the governor shall appoint such physicians as he may choose, having regard to maintaining the same proportion of regular, homeopathic, and eclectic physicians as constituted the original board.

Vacancies in said board shall be filled by the governor and the person appointed to fill a vacancy shall hold office during the unexpired term of the member whose place he is to fill, and shall be of the same school of practice.

. . . . . .

Sec. 7.—Any person twenty-one years of age and of good moral character, who is a graduate of a legally chartered medical college or university, having power to confer degrees in medicine and surgery, and such medical college or university being recognized as determined by the board, shall upon payment of a fee of fifteen dollars, be entitled to examination, and, if found qualified, shall be licensed to practice medicine and surgery in this state and receive a license certificate signed by the president and secretary of the board.

A person refused a license may be re-examined at any regular meeting of the board within one year of the time of such refusal without additional fee. . . . .[1]

Sec. 8.—The examination shall be in whole, or in part, in writing and shall be of a practical character, sufficiently strict to test the qualifications of the applicant as a practitioner of medicine.

The examination shall embrace the general subjects of anatomy, physiology, chemistry, pathology, practice of medicine, surgery, obstetrics, gynecology, hygiene, and materia medica; but it is hereby

[1] As amended in 1906.

provided the examination in materia medica shall be conducted by the members of the board who represent the same school of practice as that of which the applicant is a graduate.

Each applicant shall pass at least an average of 75 per cent to entitle him to a license.

SEC. 9.—A person to whom a license certificate is thus issued in order to make it valid shall within thirty days from date thereof, cause the same to be recorded in the office of the secretary of state, in a book to be provided by said secretary of state, for that purpose for which the record fee shall be twenty-five cents.

. . . . . .

SEC. 11.—Any person who shall advertise or hold himself out to the public as a physician or surgeon, or who shall assume the title of doctor in the treatment of disease by any system or method shall, for the purposes of this act be deemed a physician or practitioner of medicine or surgery. Nothing, however, in this act shall in any way affect the provisions of No. 110 of the acts of 1902 or apply to persons licensed by any other board having legal authority to issue licenses in this state.

SEC. 12.—It shall be the duty of the board to investigate all complaints of disregard, noncompliance or violation of the provisions of this act, and to bring all such cases to the notice of the proper prosecuting officer.

SEC. 13.—This act shall not apply to persons legally licensed to practice medicine and surgery under the provisions of former acts nor to persons who resided and practiced medicine in the state five years previous to the 28th day of November, 1876, nor to commissioned officers of the U. S. army, navy, or marine hospital service, nor to the practice of midwifery by women in the town or locality in which they reside, nor to a physician or surgeon who is called from another state, or the Dominion of Canada, to treat a particular case, and who does not otherwise practice in this state, provided however, that such non-resident physician is legally licensed where he resides and provided further that the state from which he comes or the Dominion of Canada, grants the same privilege to legally licensed practitioners of the state of Vermont.

Nothing in this act, however, shall be construed to permit any non-resident physician or surgeon from coming into the state in consultation with a legally qualified practitioner in this state.

SEC. 14.—The board shall issue licenses without examination to reputable physicians and surgeons who shall personally appear and present a certified copy of certificate of registration, or license, which has been issued to said applicant in another state in the union where the requirements for registration shall be deemed by said board to be equivalent to those of this state, provided such state shall accord a like privilege to holders of a license granted under the laws of this state.

Each applicant for such license shall pay to the board the sum of ten dollars.

VIRGINIA

Medical Laws of Virginia.

An act to amend and re-enact an act entitled an act to amend and re-enact sections 1744, 1745, 1746, 1747, 1749, 1750 and 1752, of Chapter 77 of the Code, regulating the practice of Medicine and Surgery in Virginia. Approved March 7, 1900.

Sec. 1744.—*Board of Medical Examiners; number and terms of members.* There shall be for this state a board of medical examiners consisting of one member for each congressional district in this state, and three for the state at large, and in addition, two homeopathic physicians from the state at large, whose term of office shall be for four years or until their successors are appointed and qualified. The term of office of the board first appointed after this act takes effect shall commence on the first day of April, nineteen hundred and two, but the board in office under the law in force at the time of the passage of this act shall constitute a board of medical examiners under this act until a new board shall be appointed and qualified.

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Sec. 1747.—*Examination of applicants for the practice of medicine and surgery; re-examination; fees of Board.* [This Act has been amended and re-enacted by an Act approved April 23, 1903, which reads as follows:]

It shall be the duty of the said board, at any of its said meetings, to examine all persons making application to them, who shall desire to commence the practice of medicine or surgery in this State; provided, said applicant shall produce before said Board a diploma, or other satisfactory evidence of his graduation in some medical college or institution teaching the art of healing human diseases chartered by the State or Territory in which the same is situated; provided, that any under-graduate taking a graded course in any regularly chartered medical school such be entitled to examination on such branch or branches as he or she may present a certificate from the said college of having passed a satisfactory examination, and having once passed a satisfactory examination on each of such branches before the State Board of Medical Examiners, no further examination shall be required on such branch or branches; but an applicant failing to pass a satisfactory examination on any of such branches shall not be permitted to be examined on any such branch or branches until he or she presents a diploma of graduation as doctor of medicine from some regularly chartered college of medicine. And when an applicant shall have passed an examination satisfactory as to proficiency before the Board in session, the president thereof shall grant

to such applicant a certificate to that effect: provided, however, that any applicant professing a system of medicine which does not require the use of drugs in the treatment of disease shall be exempt from standing an examination of materia medica.

A fee of ten dollars shall be paid to said Board, through such officers or members as it may designate, by each applicant before such examination is had. And in case any applicant shall fail to pass a satisfactory examination, he shall not be permitted to stand any further examination within the next six months thereafter, nor shall he have again to pay the fee prescribed as aforesaid: provided however, no applicant shall be rejected upon his examination on the account of his adherence to any particular school of medicine or system of practice, nor on account of his views as to the method of treatment and care of diseases: and provided, further, that when in the opinion of the president of the Board any applicant has been permitted by good cause from appearing before the Board, he shall have authority, in his discretion, to grant a special permit to such applicant to practice medicine or surgery until he shall have an opportunity to appear before the board in session for examination, which said special permit shall be revokable at the discretion of the president: and in no case shall it entitle the holder thereof to practice after the next regular meeting of said board.

The said board shall have, in their discretion, authority to accept in lieu of examination of an applicant, a diploma or other satisfactory evidence of the graduation of the applicant in some medical college chartered by the State or Territory in which the same is situated, and a certificate from the examining board of any State or Territory of the United States or the District of Columbia showing that said applicant has passed a satisfactory examination as to his proficiency, and obtained license from said board to practice medicine and surgery in said State, Territory, or district, provided, that any person who was examined by the State Examining Board prior to January first, nineteen hundred, and whose fee for such examination was duly paid, but who failed to pass said examination, shall have the right and privilege of taking the examination before the State board, notwithstanding the provisions of this act.

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Sec. 1749.—*Applicant to have certificate of Board recorded; fee of Clerk.* Before any person who obtains a certificate as aforesaid may lawfully practice medicine or surgery in this State, he shall cause the said certificate to be recorded in the clerk's office of the county or corporation in which he resides in this State, or if he resides in the city of Richmond, in the clerk's office of the Chancery Court of said city; but if he does not reside in the State of Virginia, he shall cause the said certificate to be recorded in the clerk's office of the county or corporation in which he offers to practice in this State, or in the clerk's office of the Chancery Court of the city of Richmond, if he offers to practice in said

city. The certificate shall be recorded by the clerk in a book to be kept for that purpose, and it shall be indexed in the name of the person to whom the certificate is granted. The clerk's fee for recording shall be the same as for recording a deed.

SEC. 1750.—*Who prohibited from practicing medicine or surgery without a certificate; penalty for practicing illegally; what courts have jurisdiction to inflict.* [This act has been amended and re-enacted by an Act approved April 24, 1903, and should read as follows]: No person who shall have commenced the practice of medicine or surgery in this State since the first day of January, eighteen hundred and eighty-five, or who shall hereafter commence the practice of the same, shall practice as a physician or surgeon for compensation without having first obtained a certificate from the State board of medical examiners and caused the same to be recorded as aforesaid, or a special permit from the president of said board. . . . .

Provided, that nothing in this section shall be construed to apply to or limit in any manner the manufacture or sale of proprietary medicines, or to apply to, affect or interfere in any way with the operation of any hospital now established in this State, or any person while engaged in conducting such hospital, if there be a licensed physician resident and practicing therein, or to any person who commenced the practice of osteopathy in this State prior to January first, nineteen hundred and three. . . . .

. . . . . .

SEC. 1752. *Who exempt from examination.*—Nothing in this chapter shall be taken as including or effecting in any way any dentist or midwife, nor any commissioned officer or contract surgeon of the United States army, navy, or marine hospital service in the performance of his duties as such, nor to any physician or surgeon residing in any other State or Territory of the United States, or in the District of Columbia, called into consultation in a special case with a physician or surgeon residing in this State, nor shall this chapter be construed as effecting or changing in any way the laws in reference to the license tax required to be paid by physicians, surgeons and dentists.

WASHINGTON

Ballinger's code, 1897.

Regulating the Practice of Medicine.

§3012. *Governor to Appoint Board of Examiners—Term.*—The Governor of this State shall appoint a board of examiners, to be known as the State medical examining board, consisting of nine members, who shall be learned and skilled in the practice and theory of medicine and surgery, and who shall hold their office for three years, and. . . . .

. . . . . .

§3014. *Board Shall Examine Applicants and Grant Licenses.*—(As amended by law of 1905.) Hereafter every person desiring to commence the practice of medicine and surgery, or either of them, in any of its or their branches, in this state, shall make a written application to said board for a license so to do. Each applicant for such license shall be not less than twenty-one years of age, shall furnish a certificate of good moral character, shall be a graduate of some duly authorized medical college now having, if it still be in existence, at least a four years' graded course. Such applicant at the time and place designated by said board, or at the regular meeting of said board, shall submit to an examination in the following branches: Anatomy, physiology, chemistry, histology, materia medica, therapeutics, preventive medicines, practice of medicine, surgery, obstetrics, diseases of women and children, diseases of the nervous system, diseases of the eye and ear, medical jurisprudence and such other branches as the board shall deem advisable. Said board shall cause such examination to be both scientific and practical and of sufficient severity to test the candidate's fitness to practice medicine and surgery; which examination shall be by written or printed; or partly written or partly printed quest ons and answers and the same shall be filed and preserved of record in the office of the secretary of the board. After examination, if the same be sat sfactory, said board shall grant a license to such applicant to practice medicine and surgery in the State of Washington, which said license can only be granted by the consent of not less than five members of said board, except as hereinafter provided and which said license shall be signed by the president and secretary of said board, and attested by the seal thereof. The fee for such examination shall be twenty-five dollars and shall be paid by the applicant to the treasurer of said board toward defraying the expenses thereof and toward the enforcement under the supervision and control of said board of the provision of this act; and such board may refuse or revoke a license for unprofessional or dishonorable conduct, subject, however, to the

right of such applicant to appeal from the decision of said board refusing or revoking such license as hereinafter provided.

§3015. *Acts Constituting Unprofessional Conduct.*—The words "unprofessional or dishonorable conduct," as used in the last preceding section, are hereby declared to mean,

1. The procuring or aiding or abetting in procuring a criminal abortion;

2. The employing of what are popularly known as "cappers" or "steerers";

3. The obtaining of any fee on the assurance that a manifestly incurable disease can be permanently cured;

4. The willfully betraying of a professional secret;

5. All advertising of medical business in which untruthful and improbable statements are made;

6. All advertising of any medicine or of any means whereby the monthly periods of women can be regulated or the menses re-established if suppressed.

7. Conviction of any offense involving moral turpitude;

8. Habitual intemperance.

. . . . . .

§3018. *License to be Recorded—List Furnished.*—(From Ballinger's Code Suppl. Vol. 3.) The person receiving said license shall before he or she commences the practice of medicine or surgery or any of their branches file the same, or a certified copy thereof, with the county clerk, and for the county where he or she resides, and said county clerk shall file said certificate, or copy thereof, and enter a memorandum thereof giving the date of said license and name of the person to whom the same was issued, and the date of such filing, in a book to be provided and kept for that purpose; and said county clerk shall . . . . .

§3019. *Penalties for Practicing without License.*—(From Ballinger's Code Suppl. Vol. 3.) Any person practicing medicine or surgery or either of its or their branches within this state without first having obtained, and filed the license provided for in this act, or contrary to the provisions of this act, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined not less than fifty dollars nor more than one hundred dollars or by imprisonment in the county jail not less than ten days nor more than ninety days, or by both such fine and imprisonment. In all prosecutions under the provisions of this act, evidence that the defendant has failed to file a license with the county clerk as herein required, shall be prima facie evidence that the defendant is not a legally licensed practitioner. And each day of such illegal practice shall be deemed a separate offense under this act. All fines collected under the provisions of this act shall be paid into the state treasury for the use and benefit of the common school of this state. Any person shall be deemed as practicing within the meaning of this act who shall have and maintain an office or place

of business with his or her name and the words physician or surgeon, "Doctor," "M. D." or "M. B." in public view, or shall assume or advertise the title of doctor or any title which shall show or shall tend to show that the person assuming or advertising the same is a lawful practitioner of any of the branches of medicine or surgery in such a manner as to convey the impression that he or she is a practitioner of medicine or surgery under the laws of this state; or any person who shall practice medicine or surgery under a false or assumed name, or under cover of the name of some legal practitioner, or personate any legal practitioner or for a fee prescribe or direct, or recommend for the use of any person any drug or medicine for the treatment, care or relief of any wounds, fracture or bodily injury, infirmity or disease: Provided however, That this act shall not apply to dentists while confining themselves strictly to dentistry. Justices of the peace and the superior court shall have concurrent jurisdiction of violations of this act; it shall be the duty of the respective county or district attorneys to prosecute all violations of this act. In cases of appeal to the superior court as hereinbefore provided it shall be the duty of the prosecuting attorney of the county wherein such appeal shall be tried to represent said board upon said appeal. And in all cases of appeal to the supreme court under the provisions of this act the attorney-general shall represent said board upon such appeal.

WEST VIRGINIA

1906 Code. Chapter 150.

§4386. Physicians and Surgeons—Who may Practice Medicine—Examinations by State Board of Health—Certificates.

Sec. 9.—The following persons and no others shall hereafter be permitted to practice medicine in this state.

1st. All such persons as will be legally entitled to practice medicine in this state at the time of the passage of this act.

2nd. All such persons as shall be graduates of a reputable medical college, recognized as such by the State Board of Health, who shall pass an examination before said state board of health and shall receive certificates therefrom, as hereinafter provided. *Provided*, also, that the state board of health, or a majority of them, may accept in lieu of an examination, the certificate of license to practice medicine legally granted by the board of registration or examination or licensing board of any other state, territory or any foreign country whose standard of qualification for the practice of medicine is equivalent to that of this state, and grant to applicant a certificate of license to practice medicine in this state; *provided*, such states, territories or foreign countries accord like privilege to medical licentiates of this state. The state board of health shall at such times as a majority of them may deem proper hold examinations for the licensing of practitioners of medicine; such examinations shall not be less in number than three during each year, and shall be held at such points in the state as shall be most convenient to those presenting themselves for examination, or to the state board of health, at such examinations written and oral questions shall be submitted to the applicants for license governing all the essential branches of the sciences of medicine and surgery, and the examination shall be a thorough and decisive test of the knowledge and ability of the applicants. The president and secretary of the state board of health shall issue certificates to all who successfully pass the said examination, and to all those whose certificates said board of health or a majority of them shall accept in lieu of an examination as hereinbefore provided, except that in all the certificates issued to applicants who adhere to the osteopathic school it shall appear that it is for the practice of osteopathy, and such certificates after being duly recorded as hereinafter provided, shall be deemed licenses to practice medicine, surgery and osteopathy in all their branches in this state. The state board of health shall give timely notice of the time and place of holding each such examination,

by publishing such notice in at least three newspapers of general circulation in this state, and all such persons wishing to present themselves for examination shall notify the secretary and comply with the rules of the state board of health. No applicant for license to practice medicine in this state shall be rejected because of his or her adherence to any particular school or theory of medicine. The state board of health shall call to their assistance in the examination of any applicant who professes the homeopathic, osteopathic or eclectic school of medicine, a homeopathic osteopathic or eclectic physician entitled to practice medicine in this state under this act, and such homeopathic, osteopathic or eclectic physician so called to the assistance of the state board of health, shall be allowed the per diem and actual expenses incurred hereinbefore allowed to regular members of the state board of health; *provided, however,* that the provisions of this and the preceding section shall not apply to physicians living in other states and duly qualified to practice medicine therein, who shall be called into consultation into this state, by a physician legally entitled to practice medicine in this state under this chapter, *and, provided, further,* that the provisions of this chapter shall not apply to females practicing midwifery, or to commissioned officers of the United States army and navy and marine hospital service when in the actual discharge of their duties as such commissioned officer; *provided, further,* that this act shall not apply to osteopathic physicians practicing in the state at the time this act takes effect who are graduates of any recognized, reputable school of osteopathy.[1]

§4387. *Same—Certificates—Recording—Refusal or Revocation.—*

Sec. 10.—Every person holding any such certificate, as is hereinbefore provided for, shall have the same recorded in the office of the secretary of the state board of health, in a book to be kept by him for that purpose, and the secretary shall endorse on said certificate, the fact of such recordation and deliver the same to the person named therein or to his order. The state board of health may refuse certificates to individuals guilty of malpractice or dishonorable conduct, and they may revoke certificates for like causes. Such revocation being after due notice and trial by the board of health, with right of appeal to the circuit court of the county in which such individual resides; but no such refusal or revocation shall be had or made by license of the individual belonging to or practicing in any particular school or system of medicine.

§4388. *Same—Examinations—Fees—Re-examination.—*

Sec. 11.—Every person on presenting himself for examination as hereinbefore provided, shall pay to the state board of health, or to the members thereof by whom he is examined, a fee of ten dollars, which shall not be returned if a certificate be refused him; but he may again at any time within one year after such refusal present himself for ex-

[1] As amended by Laws of 1907.

amination as aforesaid, without the payment of an additional fee, and if a certificate be again refused him, he may as often as he sees fit thereafter, on the payment of a fee of ten dollars, he examined as herein provided until he obtains such certificate. All other persons who shall be granted a license to practice medicine in this state under the provisions of section nine of this chapter shall each pay a fee of twenty-five dollars to the state board of health.[1]

Section 12 of chapter 150 of the code of 1906 has been repealed.

[1] As amended by Law of 1907.

WISCONSIN

Laws of 1903, Chapter 426.

An Act relating to the state board of medical examiners, and to the registration and licensing of persons engaged in the practice of medicine, surgery, or osteopathy in the State of Wisconsin.

The people of the state of Wisconsin, represented in Senate and Assembly do enact as follows:

Section 1.—The governor shall appoint a board of medical examiners to be known as the Wisconsin State Board of Medical Examiners, consisting of eight members. . . . .

Section 2.—Said board shall annually, at its July meeting, elect from its members a president, secretary, and treasurer, and shall have a common seal. The president and secretary may administer oaths for the accomplishment of the objects of the board. Said board shall hold regular meetings on the second Tuesday in each January at Milwaukee, and the second Tuesday of each July at Madison, and such other meetings at such other times and places as it may from time to time determine. The board shall keep a record of all of its proceedings and also a register of all applicants for license, together with a record showing their ages, time spent in the study of medicine and the name and location of all institutions granting to such applicants, degrees or certificates of lectures in medicine, surgery or osteopathy. Said register shall also show whether such applicant was rejected or licensed, and said books and register shall be prima facie evidence of all the matters kept therein.

Section 3.—All persons commencing the practice of medicine, surgery, or osteopathy in any of their branches in this state, shall apply to said board at the time and place designated by said board, or at any regular meeting thereof for license so to practice, and shall present to said board a diploma from a reputable college of medicine and surgery or osteopathy. A college to be deemed reputable by this board shall require at least four courses of not less than seven months each, before graduation, no two of such courses to be taken within any one twelve months, and that shall require for admission thereto a preliminary education equivalent to that required for entrance to the junior class of an accredited high school in this state, including a one year's course in Latin, and that shall after the year 1906 require for admission to such school a preliminary education equivalent to graduation from an accredited high school of this state, and shall submit to an examination in the various branches in medicine and surgery usually taught in reputable medical colleges, or if the applicant be an osteopath he or she shall present a diploma from a regularly conducted college of osteopathy

maintaining a standard in all respects equal to that hereby imposed on medical colleges as to preliminary education, said college after 1904 to give three courses of eight months each no two courses to be given in any one twelve months, and after the year 1909 such college shall give four courses of seven months each, as hereinbefore provided for medical colleges and shall pass the regular examination of such board in anatomy, histology, physiology, obstetrics, gynecology, pathology, urinalysis, chemistry, toxicology, dietetics, physical and general diagnosis, hygiene, and theory and practice of osteopathy. The examination in Materia Medica, Therapeutics and Practice shall be conducted by members of the board representing the school of practice which the applicant claims or intends to follow. After examination as hereinbefore provided, the board shall, if it find the applicant qualified, grant a license to said applicant to practice medicine and surgery in all their branches in this state, or a license to practice osteopathy therein, which license can only be granted by the consent of not less than six members of said board, and which, after the payment of fees, as hereinafter provided, shall be signed by the president and secretary thereof, and attested by the seal of the board. Osteopaths when so licensed, shall have the same rights and privileges and be subject to the same laws and regulations as practitioner of medicine and surgery, but shall not have the right to give or prescribe drugs or to perform surgical operations. The fee for examination shall be fixed by the board, but shall not exceed $15.00 in each case, with $5.00 additional for the license, if issued. Such fee or fees shall be paid by the applicant to the treasurer of the board and may be applied toward defraying any proper and reasonable expenses of the board; provided, however, that any student who is exempted as a matriculant of any medical college of this state under chapter 306 of the laws of 1901, whose name is now on file with the Wisconsin State Board of Medical Examiners, shall on the presentation of a diploma from any Wisconsin college, and on the payment of the fees specified in this act, and having satisfied said board that he or she is a person of good moral character, be licensed to practice without further examination by such board, provided that said college maintains its standard herein required.

Every person practicing medicine or surgery in the state of Wisconsin, who at the time and publication of this act, has not received a license from said board, and who shall after such passage and publication present a diploma from a reputable medical college and give satisfactory evidence of having been a reputable practitioner of medicine and surgery in the state of Wisconsin continuously since the first day of July, 1897, shall be granted a license without examination upon the payment of a fee not exceeding $5.00, as determined by said board. Any person applying for such license shall if he or she be possessed of a certificate of registration issued under and according to the provisions of chapter 87 of the laws of 1899, present such certificate to said board with the diploma and application of such license, and surrender said certificate on the issuance of said license, the registration fee paid for same shall

be deducted from the last named fee. Any practitioner of medicine or osteopathy holding a certificate from any other state board imposing requirements equal to those established by the board provided for herein may on presentation of the same with a diploma from a reputable medical or osteopathic college, be admitted to practice within this state without an examination, at the discretion of the board, on the payment of the fee fixed by the board, not exceeding the sum of $25.00.

SECTION 4. . . . .

The provisions of this act shall not apply to commissioned surgeons of the United States army, public health and marine hospital service, or to physicians or surgeons of other states or countries in actual consultation with resident physicians of this state.

And provided further, that any practitioner of medicine or surgery, holding a license from the state board of medicial examiners of any adjoining state, dated since January 1, 1901, shall on presentation of the same within one year from the taking effect of this act, accompanied by a certificate from the secretary of the state board of medical examiners of the state issuing the license that such applicant is a reputable practitioner of medicine and surgery in this state without an examination, at the discretion of the board on payment of the fee.

SECTION 5.—Every person hereafter practicing medicine, surgery or osteopathy in this state shall be required to have the license herein provided for, or heretofore issued by the Wisconsin State Board of Medical Examiners, or a certificate of registration issued pursuant to the provisions of chapter 87 of the laws of 1899, and any person having or hereafter receiving a license according to the provisions of this act, or having such certificate of registration, shall record the same with the county clerk of any county in which said person shall practice and pay to said clerk or clerks a fee of fifty (50) cents each for recording the same, and said clerk shall enter a memorandum thereof, giving the date of said license or certificate, the name of the person to whom it was issued, school of practice chosen, and the date of such recording in a book to be provided and kept for that purpose. Any such person who shall fail to record his or her license or registration certificate, as herein provided, shall not exercise any of the rights or privileges conferred by such license or certificates. . . . .

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STATE OF WISCONSIN, IN ASSEMBLY. SUB. FOR NO. 353 A.

A BILL Empowering and requiring the Wisconsin State Board of Medical Examiners to refuse to grant licenses or certificates of registration to persons guilty of immoral, dishonorable or unprofessional conduct and empowering the courts to revoke and annul any license or certificate issued to any person guilty of immoral, dishonorable or unprofessional conduct, or fraud or perjury in connection with obtaining such license or certificate or through error.

The people of the State of Wisconsin, represented in Senate and Assembly do enact as follows:

SECTION 1.—It is hereby made the duty of the Wisconsin State Board of Medical Examiners to refuse to license or grant a certificate of registration to any person guilty of immoral, dishonorable or unprofessional conduct. The circuit courts of this state are hereby vested with jurisdiction and power to revoke and annul any license or certificate of registration which has been heretofore or which may be hereafter issued to any person to practice medicine or surgery or osteopathy in this state, who is guilty of immoral, dishonorable or unprofessional conduct, or who has procured such license or certificate of registration by fraud or perjury, or where the same was obtained through error. Upon a verified complaint in writing being made by any person, to the district attorney of any county, charging any person holding such license or certificate with having, in said county, been guilty of any immoral, dishonorable or unprofessional conduct, as defined in this act, or with having procured such certificate or license by fraud or perjury, or through error, said district attorney shall commence and prosecute an action in the circuit court of said county, against the person so complained against, to revoke and annul such license or certificate of such person. Such action shall be commenced and prosecuted as a civil action in the name of the State of Wisconsin as plaintiff, and against such person complained against as defendant, and the rules of pleading, evidence and practice in civil actions in the Circuit Court shall be applicable thereto, and either party may appeal from the circuit court to the supreme court as in other civil actions. Either party in said action may demand a jury trial, and the defendant shall have the right to be represented by counsel and the court may permit counsel to assist the district attorney in the prosecution of such action. The costs of such prosecution shall be paid by the county in which said action is brought. If, upon the trial of such action, the court finds, or the jury returns a verdict in favor of the plaintiff, judgment shall be rendered revoking and annulling such license and certificate of the defendant, and the clerk of the circuit court shall forthwith cause a certified copy of such judgment to be sent to the Secretary of the Wisconsin State Board of Medical Examiners to be filed for record in the office of said Secretary. Any person whose license or certificate has been revoked under the provisions of this act, who shall thereafter practice, or offer or attempt to practice medicine, surgery or osteopathy in this state shall be punished as provided in Chapter 426 of the Laws of 1903. No person shall be excused or privileged from testifying fully under oath or producing evidence documentary or otherwise, in any action, proceeding or examination brought under the provisions of this act; but no person shall be prosecuted or subjected to any penalty for or on account of any transaction, matter or thing, concerning which such person may so testify or produce evidence, documentary or otherwise, except for perjury omitted in giving such testimony. If the court before which the trial is had shall determine that the com-

plaint made to the district attorney was willful and malicious and without probable cause, it shall enter judgment against the person making such complaint for the costs of such action, and payment of the same may be enforced by execution against the body of such complainant as in tort actions.

SECTION 2.—The words "immoral, dishonorable or unprofessional conduct" as used in section one of this act are hereby declared to mean: First, procuring, aiding or abetting a criminal abortion; second, advertising, either in his own name or in the name of another person, firm association or corporation, in any newspaper, pamphlet or other written or printed paper or document, in any obscene manner or in a manner derogatory to good morals the curing of venereal diseases, the restoration of "lost manhood," or the advertising of any medicine or any means whereby the monthly periods of women can be regulated or the menses re-established, if suppressed, or being employed by or in the service of any person, firm, association or corporation so advertising; third, the obtaining of any fee on the assurance that a manifestly incurable disease can be permanently cured; fourth, willfully betraying a professional secret; fifth, indulging in the drug habit; sixth, conviction of any offense involving moral turpitude.

WYOMING

CHAPTER 45. HOUSE BILL NO. 71. BOARD OF MEDICAL EXAMINERS.

AN ACT to amend and re-enact Chapter 5, Division one, Title XVI, Revised Statutes of 1899, relating to the State Board of Medical Examiners.

BE it enacted by the Legislature of the State of Wyoming:

APPOINTMENT OF BOARD.

SECTION 1.—The Governor, by and with the consent of the Senate, shall appoint three regularly licensed physicians of the State of Wyoming, who shall constitute the State Board of Medical Examiners, and who shall hold office for a term of four years. Any vacancy which may occur in said Board from any cause shall be filled by appointment by the Governor, and the physician so appointed shall hold his office until the expiration of the term.

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DUTIES.

SECTION 3.—It shall be the duty of the said Board to pass upon the qualifications and determine the fitness of all persons who may desire to practice medicine, surgery, and obstetrics, or who may publicly profess in any manner to assume the responsibility of the care or treatment of disease, injury or deformity of human beings in the State.

REQUIREMENTS.

SECTION 4.—Every person wishing to practice medicine in any of its departments in this State shall possess the qualifications required by this Act. He shall be a graduate from a regularly chartered college of the system which he claims to practice, said college must be recognized by the State Board of Health, or the State Board of Medical Examiners of the State in which it is located. He shall give evidence of the fact that he is a person of good moral character and that he shall not be the victim of such habits as shall cause him to endanger the lives of those entrusted to his care. He shall present his diploma to the State Board of Medical Examiners for verification as to its genuineness, said certification shall consist in the affidavit of the holder of the diploma that he is the lawful possessor of the same and that he is the person therein named. Such affidavit may be taken before any person authorized to administer oaths and the same shall be attested under the hand and seal of such officer. He shall appear before the State Board of Medical

Examiners in person at a time and place appointed and shall pass an examination sufficiently strict to test his qualifications as a practitioner. Said examination may be in whole or in part in writing. It shall be of an elementary and practical character, and shall be upon the following subjects: Anatomy, Physiolgy, Chemistry, and Toxicology, Pathology, Physical Diagnosis, Gyenecology, the Principles of Surgery, Obstetrics, Hygiene, and Bacteriology. He shall further be required to pass an examination in such branches as are necessary to complete the system of which he is a practitioner. If the applicant is a practitioner of any school or system not represented in the membership of the Board, the Board shall have authority to call a regularly licensed practitioner of that system to assist in the examination. The practitioner thus called shall receive a compensation of five dollars for each person examined. An average grade of seventy-five per cent in all branches of the examination shall be required provided, that the applicant shall not pass lower than sixty per cent in any one branch. Said examination shall be conducted by and under the supervision of the Secretary of the Board with such assistance from the other members as shall be agreed upon by them. Said examinations shall be held at stated periods to suit the convenience of the Board and applicants, provided, that not more than four examinations shall be held in any one year.

The President and Secretary of the State Board of Medical Examiners shall issue certificates to all persons who successfully pass said examinations and such certificates, after being duly recorded as hereinafter provided, shall be deemed license to practice medicine in all branches in which the applicant has taken examination in this State. No application for license to practice medicine in this State shall be rejected because of adherence to a particular school of practice. All persons who are licensed practitioners in this State prior to the passage of this Act shall be exempt from its requirements.

Applications—Fees.

Section 5.—The State Board of Medical Examiners shall receive through its Secretary, applications for certificates and examinations. A fee of twenty-five dollars shall accompany each application. Should the applicant fail to pass the examination, he may present himself at any time within a period of one year for another examination without the payment of an additional fee.

Admission Without Examination.

Section 6.—Said Board may, in its discretion, accept and register, upon payment of the registration fee, and without examination of the applicant, any certificate which shall have been issued to him by the Medical Examining Board of the District of Columbia, or of any State or Territory of the United States; provided, however, that the legal requirements of such Medical Examining Board shall have been at the

time of issuing such certificate in no degree or particular less than those of Wyoming at the time when such certificate shall be presented for registration to the Board created by this act; and provided, further, that the provisions in this section contained shall be held to apply only to such of said Medical Examining Board as accept and register the certificates granted by this Board without examination by them of the ones holding such certificates.

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Examination Papers.

Section 8.—The examination papers of applicants when placed in the hands of the Secretary shall become the property of the State and shall remain in the possession of the State Board of Medical Examiners and the questions and answers of any examinations together with the gradings thereon shall be subject to inspection at any time at the secretary's office.

Certificate to be Recorded.

Section 9.—Every person holding a certificate as having successfully passed an examination before said Board of Medical Examiners shall have the same recorded at the office of the County Clerk of the County in which he resides and the date and place of record shall be endorsed thereon. Any person moving to another county to practice shall procure a certificate to that effect from the County Clerk and the holder of the certificate shall pay to the County Clerk the usual fees for making the record.

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Application of this Act.

Section 13.—Nothing in this act shall be construed to prohibit gratuitous service in case of emergency, and this Act shall not apply to commissioned surgeons of the United States Army, Navy or medical examiners of relief departments of railroad companies, while so employed or any lawfully qualified physicians residing in other States or Counties meeting registered physicians of this State in consultation, or any physician or surgeon residing upon the border of a neighboring State, and duly authorized under the Laws thereof to practice medicine and surgery therein, whose practice extends into the limits of this State. This Act shall apply to apothecaries and pharmacists who prescribe for the sick.

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Examination.

Section 15.—The State Board of Medical Examiners shall examine all persons upon the theory and practice of obstetrics who profess to

practice obstetrics and midwifery, who do not have authority to practice under the provisions of this act, or holding such certificates as are prescribed by this section, Provided, that nothing in this Section shall be construed to prohibit persons from rendering services in cases of obstetrics or midwifery in cases of emergency.

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ACTS INCONSISTENT.

SECTION 18.—All Acts and parts of Acts inconsistent with the provisions of this Act are hereby repealed.

SECTION 19.—This Act shall take effect and be in force from and after its passage.

Approved February 15, 1905.

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